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ABSTRACT

This packet contains teacher and student editions for lawn and garden equipment repair and maintenance, intended for the preparation of power product equipment technicians. This publication contains four units: (1) introduction to lawn and garden equipment; (2) light-duty lawn and garden equipment; (3) heavy-duty lawn and garden equipment; and (4) chain saws. The materials are based on the curriculum-alignment concept of first stating the objectives, developing instructional strategies for teaching to those objectives, and assessing to those same objectives. Each instructional unit in the teacher edition includes some or all of the following components for each of the four units of instruction: suggested activities, answers to assignment sheets, answers to written test, written test, unit evaluation form, transparency masters, and worksheet masters. The teacher edition also contains information on use of the publication, a competency profile for recording students performance, instructional and task analysis, academic and workplace skill classifications and definitions, and a list of related academic and workplace skills. Each unit in the student edition includes some or all of the following components: objective sheets, information sheet, student supplements, assignment sheets, and job sheets. (KC)

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Power Product Equipment Technician

Lawn and Garden Equipment

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Teacher Edition

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Power Product Equipment Technician:

Lawn and Garden Equipment

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Lawn and Garden Equipment

Teacher Edition

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Foreword

Power Product Equipment Technician: Lawn and Garden Equipment is one in a series of new publications developed to replace MAVCC's previous small-engine series.

Three new publications in the new *Power Product Equipment Technician* series have been developed to replace the core publication for MAVCC's previous small-engine series.

- The first publication, *Theory and Principles of Engine Operation,* is divided into two sections: Section A, "Orientation," and Section B, "Basic Engine Theory and Operation." Section A covers basic workplace safety and first aid, common hand tools, common fasteners, and related math and measuring. Section B addresses reference materials, basic engine principles, engine design and identification, engine operation, and parts management, inventory control, and service orders.
- The second publication, *Engine Systems and Service,* is also divided into two sections: Section A, "Engine Systems," and Section B, "Engine Overhaul." Section A covers lubrication systems, cooling systems, fuel systems, governor systems, basic electrical principles, ignition systems, starting systems, charging systems, and exhaust systems. Section B addresses engine overhaul, troubleshooting, and failure analysis.
- *Equipment Systems,* the third publication, consists of seven units that cover principles of power transmission, mechanical drive systems, principles of fluid power, hydraulic and pneumatic drive systems, wheel and brake systems, chassis and steering systems, and chassis electrical systems.

Three spin-off publications follow the core materials and complete the new *Power Product Equipment Technician* series: *Lawn and Garden Equipment, Construction Equipment,* and *Outboard-Engine Systems and Service.*

This publication, *Lawn and Garden Equipment,* contains four units:

- Unit 1: Introduction to Lawn and Garden Equipment
- Unit 2: Light-Duty Lawn and Garden Equipment
- Unit 3: Heavy-Duty Lawn and Garden Equipment
- Unit 4: Chain Saws

Construction Equipment contains units on concrete equipment (powered concrete mixers, tampers, vibrators, floats, trowels, and screeds), water pumps and air compressors, and alternators, generators, and welding equipment.

Outboard-Engine Systems and Service will contain units on the power head, mid-section, and lower unit of outboard engines as well as units on trailers, boat accessories and rigging, and seasonal service.

These new instructional materials reflect the changes that have occurred in the industry as a result of emerging technology and the demand for more highly skilled workers. The growing need for entry-level workers to be able to read and interpret information provided in manufacturers' service manuals has prompted us to include assignment sheets that teach students how to use reference materials and to create job sheets with worksheets that require students to obtain specific information from a related service manual before completing a specific task.

Today's workers also need a stronger foundation in theoretical concepts and principles to help them better understand how engine systems and equipment components interrelate, and the information sheets and supplements in the student edition have been designed to help provide that foundation.

Foreword

The success of this publication is due in large part to the capabilities of the personnel who worked with its development. Appreciation is extended to them for their valuable contributions to the publication.

These instructional materials are designed for student use and to assist teachers in organizing and improving instruction. These instructional materials are based on the curriculum-alignment concept of first stating the objectives (objective sheet), developing instructional strategies for teaching to those objectives (information, assignment, and job sheets), and assessing to those same objectives (written test—a criterion-referenced evaluation instrument).

Every effort has been made to make these materials basic, readable, and by all means, usable. However, as with all of MAVCC's instructional materials, teachers must localize and personalize these materials to meet their community, classroom/laboratory, and individual student's situation. Teachers are encouraged to supplement the instructional materials and to develop strategies for motivating their students.

Special attention should be given to the matrix identifying basic academic skills being reinforced in these instructional materials as well as the suggestions on ways to increase reinforcement of academic and workplace skills. By reinforcing these skills, the instructor should assist students in improving their employability skills.

As you use these instructional materials, we hope that you will find that they contribute to the quality of your program. If any problems occur or if you have any suggestions for improvement of the materials, please call or write us.

Sue Ethelbah, Chair
Board of Directors
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Vocational Curriculum Consortium, Inc.

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Appreciation is also extended to Nancy Hilley for providing some of the original artwork used within this publication and to Mike Barnett, MTD Products, Inc., for providing the artwork used on the covers of the student and teacher editions of this publication.

Use of Introductory Materials

Introductory materials are included in the teacher edition only and contain useful information to assist administrators and teachers in planning for instruction.

In addition to the general information—such as the table of contents, foreword, and acknowledgments page—information is included on the following:

1. **Use of this publication**—Explains the components of a unit of instruction and how they should be used as part of the teaching/learning process.
2. **Competency profile**—Provides a record of student performance for each task included in a unit of instruction. This profile becomes a part of the student's permanent records and should be utilized when directing the student toward employment opportunities.
3. **Instructional/task analysis**—Provides a quick review of the contents of the publication; identifies cognitive (knowledge) skills and psychomotor (doing) skills addressed in each unit of instruction.
4. **Academic and workplace skill classifications and definitions**—Defines the basic-skill classifications used by MAVCC. Skill areas reflected by skill groups, subskills, and descriptions have been identified using *What Work Requires of Schools: A SCANS Report for America 2000* and *Workplace Basics: The Skills Employers Want*. These have been adapted by MAVCC.
5. **Related academic and workplace skills list**—Classifies unit tasks (assignment sheets and job sheets) according to related academic and workplace skills being reinforced.

As you use these materials, it is hoped that they will provide useful information to meet a variety of needs.

Use of This Publication

Instructional units

Power Product Equipment Technician: Lawn and Garden Equipment contains four units of instruction:

- Unit 1: Introduction to Lawn and Garden Equipment
- Unit 2: Light-Duty Lawn and Garden Equipment
- Unit 3: Heavy-Duty Lawn and Garden Equipment
- Unit 4: Chain Saws

Each instructional unit in a student edition includes some or all of the following components: objective sheet, information sheet, student supplements, assignment sheets, and job sheets.

Each section in this teacher edition includes some or all of the following components for each of the four units of instruction: suggested activities, answers to assignment sheets, answers to written test, written test, unit evaluation form, transparency masters, and worksheet masters.

All of the unit components focus on measurable and observable learning outcomes. Teachers are encouraged to supplement, personalize, localize, and motivate with these materials in order to develop a complete teaching/learning process.

Units of instruction are designed for use in more than one lesson or class period of instruction. Careful study of each unit of instruction by the teacher will help to determine the following:

- Amount of materials that can be covered in each class period.
- Skills that must be demonstrated.
- Amount of class time needed for teacher demonstrations.
- Amount of time needed for student practice.
- Supplementary materials, including print and nonprint media and equipment and supplies, that must be ordered.
- Resource people who must be contacted.

Student-edition components

It is a challenge to keep students motivated. Instructors should supplement the student-edition components by providing the "why," personal experiences, and current information. Prepare for each unit by deciding how each component can best be taught. Allow students to become involved in preparing and planning their teaching/learning experiences.

Objective sheet. Each unit of instruction is based on performance objectives that state the goals for successful completion of the course. These performance objectives are stated in two forms: unit objectives, which state the expected performance of each student after completion of the unit of instruction, and specific objectives, which state what the student must do to reach the unit objective.

The objectives should be stressed throughout the teaching/learning process. This will help answer any questions concerning performance requirements for each instructional unit. The objectives can also help determine teaching strategies and instructional methods. Teachers should prepare for each unit by deciding how each objective can best be taught.

Use of This Publication

Teachers should feel free to modify, delete, or add objectives in order to meet the needs of the students and community. When objectives are added, the teacher should remember to supply the needed information-sheet, assignment-sheet, job-sheet, and written-test items.

Information sheet. The information sheet provides the content essential for meeting the cognitive (knowledge) objectives of the unit. Teachers will find that the information sheet serves as an excellent guide for presenting background knowledge necessary to develop the skills specified in the unit objective. Students should read the information sheet before the information is discussed in class. Space is provided in margins for students and teachers to add notes that supplement, localize, personalize, or provide information for the teaching of each objective.

Student supplements. The information presented in a student supplement may consist of tables, charts, written information, forms, or other information students will need in order to complete one or more of the assignment sheets or job sheets. Students are not directly tested over the information presented in a supplement; however, their ability to apply this information is evaluated in the completion of assignment sheets and job sheets.

Assignment sheets. Assignment sheets provide students with pencil-and-paper activities that give students the opportunity to make practical application of the knowledge in the information sheet. Criteria are provided to objectively evaluate student performance.

Job sheets. Job sheets are an important segment of each unit; they give the instructor direction as to the psychomotor skills to be taught and allow both the student and instructor to check student progress toward the accomplishment of those skills. The worksheet included in each job sheet provides criteria to allow the instructor to objectively evaluate student performance of a particular psychomotor skill. The instructor should discuss the equipment and materials to be used—emphasizing the specific equipment and materials available in the classroom and/or laboratory—and demonstrate the job-sheet procedure before having students practice the psychomotor skill.

Teacher-edition components

Suggested activities. The suggested activities assist teachers during the preparation stage of the teaching/learning process by providing an instructional plan, teaching suggestions, and a list of supplemental resources. Ways to integrate academic and workplace skills have been included in the teaching suggestions, and skill areas have been noted in bold. The teacher should read the suggested activities before teaching a unit and decide how each objective can best be taught. Time should also be allowed to obtain supplemental materials, prepare audiovisual materials, and contact outside resources. Duties of the teacher will vary according to the particular unit.

References used in the development of each unit are listed in the suggested-activities section, along with suggested supplemental resources that may be used to teach the unit. These materials can be used by the teacher to supplement her or his knowledge of the subject area or to help students with particular interests or objectives in the area covered.

Assignment-sheet and written-test answers. Assignment-sheet answers and written-test answers are designed to assist the teacher in evaluating student performances on the assignment sheets and written test.

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Use of This Publication

Written test. This component is a criterion-referenced evaluation of every cognitive objective listed in the information sheet. If the instructor has added, deleted, or modified objectives, appropriate changes should be made on the written test. It is recommended that the test be divided into shorter tests covering three or four objectives at a time and given soon after those objectives have been covered. A selection of test items from the units covered may be used for final tests at the end of each term if desired. The test is included in the teacher edition only, but duplication is permitted for student use.

Unit evaluation form. This form provides teachers with a record of each student's performance on a unit of instruction. It includes space for assignment-sheet ratings, job-sheet ratings, written-test scores, and teacher comments. The unit evaluation form may also be duplicated for student use.

Transparency masters. Transparency masters are used to direct the students' attention to the topic of discussion. Transparency masters may provide illustrations, charts, schematics, or additional information needed to clarify and reinforce objectives included in the unit of instruction.

Worksheet masters. Worksheet masters provide the instructor with masters for making photocopies of the evaluation criteria used to evaluate student performance of the psychomotor skills (job sheets) included in the student edition.

Competency Profile

Name: ____

Directions: Evaluate the student using one of the optional rating scales below. Write the appropriate number/letters to indicate the degree of competency achieved. The descriptions associated with each of the numbers/letters focus on a level of student performance for each of the tasks listed. The written-test scoreline is provided for optional teacher use. It may not be applicable in all cases.

Optional rating scales

Option A

Rating scale:

4 – **Skilled** – Can perform job with no additional training
3 – **Moderately skilled** – Has performed job during training program; limited additional training may be required.
2 – **Limited skill** – Has performed job during training program; additional training is required to develop skill.
1 – **Unskilled** – Is familiar with process, but is unable to perform job.
0 – **No exposure** – No information or practice provided during training program, complete training is required.
NA – **Non-applicable.**

Option B

Yes – Can perform with no additional training
No – Is unable to perform satisfactorily

Unit 1: Introduction to Lawn and Garden Equipment

________ 1. Determine light-duty lawn and garden equipment service specifications and parts requirements
________ 2. Determine heavy-duty lawn and garden equipment service specifications and parts requirements
________ 3. ____

________Written-test score

Unit 2: Light-Duty Lawn and Garden Equipment

________ 1. Perform routine maintenance on lawn mowers
________ 2. Repair lawn mowers
________ 3. Perform routine maintenance on edgers
________ 4. Repair edgers
________ 5. Perform routine maintenance on trimmers
________ 6. Repair trimmers
________ 7. Perform routine maintenance on dethatchers
________ 8. Repair dethatchers
________ 9. Perform routine maintenance on blowers
________10. Repair blowers
________11. Perform routine maintenance on hedge clippers
________12. Repair hedge clippers
________13. Perform routine maintenance on snow blowers
________14. Repair snow blowers
________15. Perform routine maintenance on pressure washers
________16. Repair pressure washers

Competency Profile

Unit 2: **Light-Duty Lawn and Garden Equipment** (continued)

_______ 17. ______________________________

_______ Written-test score

Unit 3: **Heavy-Duty Lawn and Garden Equipment**

_______ 1. Perform routine maintenance on garden tractors and riding lawn mowers
_______ 2. Repair garden tractors and riding lawn mowers
_______ 3. Perform routine maintenance on tillers
_______ 4. Repair tillers
_______ 5. Perform routine maintenance on log splitters
_______ 6. Repair log splitters
_______ 7. Perform routine maintenance on shredders
_______ 8. Repair shredders
_______ 9. ______________________________

_______ Written-test score

Unit 4: **Chain Saws**

_______ 1. Calculate fuel-mix ratios
_______ 2. Calculate chain pitch
_______ 3. Determine chain-saw service specifications and parts requirements
_______ 4. Troubleshoot poor performance in chain saws
_______ 5. Perform routine maintenance on chain saws
_______ 6. Repair chain saws
_______ 7. ______________________________

_______ Written-test score

Comments: ______________________________

____

____

____

____

Evaluator: ____________________ **Date:** ____________________

Permission to duplicate this profile is granted.

Instructional/Task Analysis

Related information: What the student should know	Application: What the student should be able to do

Unit 1: Introduction to Lawn and Garden Equipment

1. Definition of the term *lawn and garden equipment*
2. Definitions of the terms *light-duty equipment* and *heavy-duty equipment*
3. Functions of common types of light-duty lawn and garden equipment
4. Functions of common types of heavy-duty lawn and garden equipment
5. Typical service procedures required for lawn and garden equipment
6. Determine light-duty lawn and garden equipment service specifications and parts requirements
7. Determine heavy-duty lawn and garden equipment service specifications and parts requirements

Unit 2: Light-Duty Lawn and Garden Equipment

1. Safety rules for servicing light-duty lawn and garden equipment
2. Functions of the major components of walk-behind lawn mowers
3. Operating features used to classify walk-behind lawn mowers
4. Principles of operation of self-propelled rotary walk-behind lawn mowers
5. Principles of operation of self-propelled reel walk-behind lawn mowers
6. Typical service procedures required for walk-behind lawn mowers
7. Functions of the major components of edgers
8. Operating features used to classify edgers
9. Principles of operation of edgers
10. Typical service procedures required for edgers
11. Functions of the major components of trimmers

Instructional/Task Analysis

Related information: What the student should know	Application: What the student should be able to do
Unit 2: Light-Duty Lawn and Garden Equipment (continued)	
12. Operating feature used to classify trimmers	
13. Principles of operation of trimmers	
14. Typical service procedures required for trimmers	
15. Functions of the major components of dethatchers	
16. Operating features used to classify dethatchers	
17. Principles of operation of dethatchers	
18. Typical service procedures required for dethatchers	
19. Functions of the major components of blowers	
20. Operating feature used to classify blowers	
21. Principles of operation of blowers	
22. Typical service procedures required for blowers	
23. Functions of the major components of hedge clippers	
24. Operating features used to classify hedge clippers	
25. Principles of operation of hedge clippers	
26. Typical service procedures required for hedge clippers	
27. Functions of the major components of snow blowers	
28. Descriptions of types of snow blowers	
29. Principles of operation of snow blowers	
30. Typical service procedures required for snow blowers	

Instructional/Task Analysis

Related information: What the student should know	Application: What the student should be able to do
Unit 2: Light-Duty Lawn and Garden Equipment (continued)	
31. Functions of the major components of pressure washers	35. Perform routine maintenance on lawn mowers
32. Operating feature used to classify pressure washers	36. Repair lawn mowers
33. Principles of operation of pressure washers	37. Perform routine maintenance on edgers
34. Typical service procedures required for pressure washers	38. Repair edgers
	39. Perform routine maintenance on trimmers
	40. Repair trimmers
	41. Perform routine maintenance on dethatchers
	42. Repair dethatchers
	43. Perform routine maintenance on blowers
	44. Repair blowers
	45. Perform routine maintenance on hedge clippers
	46. Repair hedge clippers
	47. Perform routine maintenance on snow blowers
	48. Repair snow blowers
	49. Perform routine maintenance on pressure washers
	50. Repair pressure washers
Unit 3: Heavy-Duty Lawn and Garden Equipment	
1. Safety rules for servicing heavy-duty lawn and garden equipment	
2. Functions of the major components of garden tractors	
3. Operating feature used to classify garden tractors	

Unit 3: Heavy-Duty Lawn and Garden Equipment

Related information: What the student should know

4. Principles of operation of garden tractors
5. Functions of the major components of riding lawn mowers
6. Operating feature used to classify riding lawn mowers
7. Principles of operation of riding lawn mowers
8. Typical service procedures required for garden tractors and riding lawn mowers
9. Functions of the major components of tillers
10. Operating feature used to classify tillers
11. Principles of operation of tillers
12. Typical service procedures required for tillers
13. Functions of the major components of log splitters
14. Operating feature used to classify log splitters
15. Principles of operation of log splitters
16. Typical service procedures required for log splitters
17. Functions of the major components of shredders
18. Descriptions of types of shredders
19. Principles of operation of shredders
20. Typical service procedures required for shredders

Application: What the student should be able to do

21. Perform routine maintenance on garden tractors and riding lawn mowers
22. Repair garden tractors and riding lawn mowers
23. Perform routine maintenance on tillers
24. Repair tillers
25. Perform routine maintenance on log splitters
26. Repair log splitters
27. Perform routine maintenance on shredders
28. Repair shredders

Instructional/Task Analysis

Unit 4: Chain Saws

Related information: What the student should know

1. Functions of the major components of chain saws
2. Principles of operation of chain saws
3. Functions of the major components of chains
4. Definitions of the parts of cutters
5. Descriptions of types of cutters
6. Functions of the major components of guide-bar assemblies
7. Types of guide bars
8. Types of chain oilers
9. Principles of operation of pulsation-pump chain oilers
10. Principles of operation of cam-operated-pump chain oilers
11. Principles of operation of gear-driven-pump chain oilers
12. Types of chain drives
13. Types of drive sprockets
14. Definitions of types of hazards associated with chain-saw operation
15. Safety rules for servicing chain saws
16. Protective equipment to be worn during chain-saw service
17. Functions of the specialty tools used in chain-saw service
18. Typical service procedures required for chain saws

Application: What the student should be able to do

19. Calculate fuel-mix ratios
20. Calculate chain pitch
21. Determine chain-saw service specifications and parts requirements
22. Troubleshoot poor performance in chain saws
23. Perform routine maintenance on chain saws
24. Repair chain saws

Academic and Workplace Skill Classifications and Definitions

Skill group	Subskill	Definition
Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task.
	Writing	Communicating a thought, idea, or fact in written form in a clear, concise manner.
	Arithmetic/ mathematics	Performing basic computations, applying estimating and reasoning skills, and solving practical problems using a variety of mathematical techniques.
	Science	Applying knowledge learned through study and practice that is based on scientific principles, methods, and techniques.
	Listening	Receiving, interpreting, and responding to verbal messages and other cues.
	Speaking	Communicating a thought, idea, or fact verbally in a clear, concise manner.
Thinking skills	Creative thinking	Using imagination to generate new ideas.
	Decision making	Specifying goals and constraints, generating alternatives, considering risks, and evaluating and choosing the best alternative.
	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results.
	Seeing things in the mind's eye	Mentally organizing and processing symbols, pictures, graphs, and other information.
	Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills.
	Reasoning	Applying a rule or principle underlying the relationship between two or more objects when solving a problem.
Personal-management skills	Responsibility	Exerting a high level of effort towards goal attainment, working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration.
	Self-esteem	Developing self-confidence and maintaining a positive view of self.
	Career awareness, development, and mobility	Assessing self accurately, setting personal goals, establishing and implementing a plan, and monitoring progress.
	Integrity/honesty	Choosing an ethical course of action when faced with making a decision that may break with personal or societal values and recognizing the impact of violating these beliefs and codes on an organization, self, and others.
	Organizational effectiveness	Adapting to the organization's goals, values, culture, and traditional modes of operation.

Academic and Workplace Skill Classifications and Definitions

Skill group	Subskill	Definition
Interpersonal skills	Teamwork	Working cooperatively with others to reach a common goal.
	Coaching	Helping others learn new skills.
	Leadership	Communicating ideas to justify position; accepting responsibility for others; and encouraging, persuading, convincing, or otherwise motivating an individual or group.
	Negotiation	Resolving conflict between two or more individuals through discussion and compromise.
	Customer service	Working and communicating with customers to satisfy their expectations.
	Cultural diversity	Working well with men and women and with a variety of ethnic, social, or educational backgrounds.
Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources or creating it, and evaluating its relevance and accuracy.
	Organization and storage	Organizing, processing, and maintaining written or computerized records and other forms of information in a systematic way.
	Interpretation	Selecting and analyzing information and communicating the results to others.
	Processing	Using computers to acquire, organize, analyze, and communicate information.
Systems	Interrelationships	Knowing how social, organizational, and technological systems work and operate effectively.
	Monitoring	Distinguishing trends, predicting impact of actions on system operations, diagnosing deviations in systems' performance, and correcting malfunctions.
	Modification and design	Making suggestions to modify existing systems to improve products or services, and developing new or alternative systems.
Technology	Selection	Choosing procedures, tools, or equipment including computers and related technologies.
	Application	Demonstrating proper procedures for setting up and operating equipment.
	Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment, including computers and other technologies.
Resources	Time	Selecting relevant, goal-related activities, ranking them in order of importance, allocating time, and understanding, preparing, and following schedules.
	Money	Using or preparing budgets, making forecasts, keeping records, and making adjustments to meet objectives.
	Material and facilities	Acquiring, storing, and using materials and space efficiently.
	Human resources	Assessing skills and distributing work accordingly; evaluating performance and providing feedback.

Related Academic and Workplace Skills List

Task	Skill group	Subskill	Definition
Unit 1: Introduction to Lawn and Garden Equipment			
Determine light-duty equipment service specifications and parts requirements (A.S. 1)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Seeing things in the mind's eye	Mentally organizing and processing symbols, pictures, graphs, and other information
		Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
	Information	Interpretation	Selecting and analyzing information and communicating the results to others
Determine heavy-duty equipment service specifications and parts requirements (A.S. 2)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Seeing things in the mind's eye	Mentally organizing and processing symbols, pictures, graphs, and other information
		Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
	Information	Interpretation	Selecting and analyzing information and communicating the results to others
Unit 2: Light-Duty Lawn and Garden Equipment			
Perform routine maintenance on lawn mowers (J.S. 1)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently

Related Academic and Workplace Skills List

Task	Skill group	Subskill	Definition
Unit 2: Light-Duty Lawn and Garden Equipment (cont.)			
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Repair lawn mowers (J.S. 2)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Perform routine maintenance on edgers (J.S. 3)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task

Task	Skill group	Subskill	Definition
Unit 2: Light-Duty Lawn and Garden Equipment (cont.)			
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Repair edgers (J.S. 4)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others

Related Academic and Workplace Skills List

Task	Skill group	Subskill	Definition
Unit 2: Light-Duty Lawn and Garden Equipment (cont.)			
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Perform routine maintenance on trimmers (J.S. 5)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Repair trimmers (J.S. 6)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results

Related Academic and Workplace Skills List

Task	Skill group	Subskill	Definition
Unit 2: Light-Duty Lawn and Garden Equipment (cont.)			
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Perform routine maintenance on dethatchers (J.S. 7)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment

Related Academic and Workplace Skills List

Task	Skill group	Subskill	Definition
Unit 2: Light-Duty Lawn and Garden Equipment (cont.)			
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Repair dethatchers (J.S. 8)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Perform routine maintenance on blowers (J.S. 9)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently

Related Academic and Workplace Skills List

Task	Skill group	Subskill	Definition
Unit 2: Light-Duty Lawn and Garden Equipment (cont.)			
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Repair blowers (J.S. 10)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Perform routine maintenance on hedge clippers (J.S. 11)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task

Task	Skill group	Subskill	Definition
Unit 2: Light-Duty Lawn and Garden Equipment (cont.)			
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Repair hedge clippers (J.S. 12)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others

Related Academic and Workplace Skills List

Unit 2: Light-Duty Lawn and Garden Equipment (cont.)

Task	Skill group	Subskill	Definition
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Perform routine maintenance on snow blowers (J.S. 13)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Repair snow blowers (J.S. 14)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results

Related Academic and Workplace Skills List

Task	Skill group	Subskill	Definition

Unit 2: Light-Duty Lawn and Garden Equipment (cont.)

Task	Skill group	Subskill	Definition
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Perform routine maintenance on pressure washers (J.S. 15)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment

Related Academic and Workplace Skills List

Task	Skill group	Subskill	Definition
Unit 2: Light-Duty Lawn and Garden Equipment (cont.)			
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Repair pressure washers (J.S. 16)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Unit 3: Heavy-Duty Lawn and Garden Equipment			
Perform routine maintenance on garden tractors and riding lawn mowers (J.S. 1)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration

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Related Academic and Workplace Skills List

Task	Skill group	Subskill	Definition
Unit 3: Heavy-Duty Lawn and Garden Equipment (cont.)			
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Repair garden tractors and riding lawn mowers (J.S. 2)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment

Task	Skill group	Subskill	Definition
Unit 3: Heavy-Duty Lawn and Garden Equipment (cont.)			
Perform routine maintenance on tillers (J.S. 3)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Repair tillers (J.S. 4)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy

Related Academic and Workplace Skills List

Unit 3: Heavy-Duty Lawn and Garden Equipment (cont.)

Task	Skill group	Subskill	Definition
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Perform routine maintenance on log splitters (J.S. 5)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Repair log splitters (J.S. 6)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner

Related Academic and Workplace Skills List

Task	Skill group	Subskill	Definition
Unit 3: Heavy-Duty Lawn and Garden Equipment (cont.)			
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Perform routine maintenance on shredders (J.S. 7)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively

Related Academic and Workplace Skills List

Task	Skill group	Subskill	Definition
Unit 3: Heavy-Duty Lawn and Garden Equipment (cont.)			
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Repair shredders (J.S. 8)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Unit 4: Chain Saws			
Calculate fuel-mix ratios (A.S. 1)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
		Arithmetic/ mathematics	Performing basic computations, applying estimating and reasoning skills, and solving practical problems using a variety of mathematical techniques

Related Academic and Workplace Skills List

Task	Skill group	Subskill	Definition
Unit 4: Chain Saws (cont.)			
Calculate chain pitch (A.S. 2)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
		Arithmetic/ mathematics	Performing basic computations, applying estimating and reasoning skills, and solving practical problems using a variety of mathematical techniques
Determine chain-saw service specifications and parts requirements (A.S. 3)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Seeing things in the mind's eye	Mentally organizing and processing symbols, pictures, graphs, and other information
		Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
	Information	Interpretation	Selecting and analyzing information and communicating the results to others
Troubleshoot poor performance in chain saws (A.S. 4)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Seeing things in the mind's eye	Mentally organizing and processing symbols, pictures, graphs, and other information
		Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
	Information	Interpretation	Selecting and analyzing information and communicating the results to others
Perform routine maintenance on chain saws (J.S. 1)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results

Related Academic and Workplace Skills List

Task	Skill group	Subskill	Definition
Unit 4: Chain Saws (cont.)			
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment
Repair chain saws (J.S. 2)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Personal-management skills	Responsibility	Working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Resources	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
	Systems	Interrelationships	Knowing how technology systems work and operate effectively
	Technology	Selection	Choosing procedures, tools, or equipment
		Application	Demonstrating proper procedures for setting up and operating equipment
		Maintenance and troubleshooting	Preventing, identifying, or solving problems with equipment

Introduction to Lawn and Garden Equipment
Unit 1

Suggested Activities

Instructional plan

Preparation

- Review unit and plan presentation. Study the specific objectives to determine the order in which you will present the objectives.

  Review the unit introduction and teaching suggestions included in the delivery and application section below, and plan classroom activities. Also note suggestions for media and supplemental materials.

  Plan presentation to take advantage of student learning styles and to accommodate special-needs students.

- Prepare the classroom by displaying posters, equipment, and tools related to lawn and garden equipment.
- Make transparencies from the transparency masters included in the teacher pages of this unit.
- Select teacher components (written test, unit evaluation form) you want to distribute to your students. Copy and prepare these components for distribution.

Delivery and application

Unit introduction

The skill areas appearing in bold-face type in the unit introduction and teaching suggestions refer to the academic and workplace skills identified in *What Work Requires of Schools: A SCANS Report for America 2000* and *Workplace Basics: The Skills Employers Want.* These have been adapted by MAVCC.

- Introduce yourself to the class and provide them with some information about your background and qualifications. Allow the students to introduce themselves, discuss their backgrounds, and explain why they are enrolled in the course.

  Discuss the course format, your policies, and the facility. Explain the concept of competency-based education and the design of the materials. If your students are familiar with your approach and with MAVCC materials from previous courses, tailor your explanation to their needs.

- Provide students with copies of the student materials. You may choose to begin by discussing the objective sheet. Review the unit and specific objectives with the students. Discuss how meeting the unit objective will improve their employability or will increase their value as an employee. Explain how the specific objectives support the unit objective. **(Listening; oral communication; adapting to the organization's traditional modes of operation; emphasizing personal and career development)**

Suggested Activities

- Introduce the unit in a way that is appropriate to your class's experience and background. Most of the equipment covered in this unit should be familiar to many of your students. The real purpose of the unit is to define lawn and garden equipment, classify power product equipment within this broad category, provide an overview of the functions of this equipment, and summarize the types of service procedures that will be covered in detail in the next two units. Tailor your presentation to support your approach to this type of equipment. Provide the students with information about the increasing popularity of power product equipment for lawn and garden applications. Use statistics that are applicable to your area. You may want to invite a representative from a company that sells lawn and garden equipment to discuss how power mowers gained popularity in the 1960s, power trimmers and edgers became common in the 1970s, in many areas sales of snow blowers and tillers zoomed during the 1980s, along with increased sales of blowers. During the last decade, riding lawn mower and garden tractor sales have climbed. Have your guest discuss these trends and what they mean to power product equipment service technicians. Your speaker may also want to speculate about trends in the future. **(Reading; listening; adapting to the organization's traditional modes of operation)**

Teaching suggestions

Objective 1 Define the term *lawn and garden equipment.*

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**
- Provide examples of lawn and garden equipment. Demonstrate their design and operation at a level appropriate to this introduction. Relate the equipment to the specific objectives in the unit. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information)**

Objective 2 Define the terms *light-duty equipment* and *heavy-duty equipment.*

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**
- Point out that the terms *light-duty equipment* and *heavy-duty equipment* are somewhat arbitrary but are useful in grouping power product equipment according to their functions, potential for power and attachments, operator interface, and other features. Relate these classifications to the next two units. Review the purposes of this unit as defined in the unit introduction. Provide examples of light- and heavy-duty lawn and garden equipment. Demonstrate their design and operation at a level appropriate to this introduction. Relate the equipment to the specific objectives in the unit. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information)**

Suggested Activities

Objective 3 State the functions of common types of light-duty lawn and garden equipment.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Use Transparencies 1 through 9, other illustrations, and actual equipment to show examples light-duty power product equipment. Demonstrate the design and operation of each type of equipment. Use a variety of designs for each type. Discuss the engines used and the operation of various systems. Discuss safety issues in operating and servicing the equipment. **(Listening; reasoning; applying technology; seeing things in the mind's eye; system interrelationships)**

Objective 4 State the functions of common types of heavy-duty lawn and garden equipment.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Use Transparencies 10 through 15, other illustrations, and actual equipment to show examples heavy-duty power product equipment. Demonstrate the design and operation of each type of equipment. Use a variety of designs for each type. Discuss the engines used and the operation of various systems. Discuss safety issues in operating and servicing the equipment. **(Listening; reasoning; applying technology; seeing things in the mind's eye; system interrelationships)**

Objective 5 List typical service procedures required for lawn and garden equipment.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Relate the service procedures listed to those topics that the students have already studied and lead them in a review of the types of service procedures that are likely to be required for engines, steering systems, drive trains, etc. Discuss specific service requirements of the equipment covered as a preview of the next two units. Emphasize products that will be serviced in your facility. Exhibit the tools, references, and resources available in your facility to support lawn and garden equipment service. Use this activity as an introduction to student completion of the assignment sheets. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Assignment Sheet 1 Determine light-duty lawn and garden equipment service specifications and parts requirements.

- Have students locate Assignment Sheet 1. Read the introduction and directions to the assignment. **(Reading/listening for content; seeing things in the mind's eye; reasoning)**

Suggested Activities

- Make resources available that will allow the students to determine the required information. Tailor the assignment sheet to equipment used in your facility. **(Listening; reasoning; writing; seeing things in the mind's eye; acquiring, organizing, interpreting, and processing information; system interrelationships)**

- Answer any student questions and have students complete Assignment Sheet 1.

Assignment Sheet 2 Determine heavy-duty lawn and garden equipment service specifications and parts requirements.

- Have students locate Assignment Sheet 2. Read the introduction and directions to the assignment. **(Reading/listening for content; seeing things in the mind's eye; reasoning)**

- Make resources available that will allow the students to determine the required information. Tailor the assignment sheet to equipment used in your facility. **(Listening; reasoning; writing; seeing things in the mind's eye; acquiring, organizing, interpreting, and processing information; system interrelationships)**

- Answer any student questions and have students complete Assignment Sheet 2.

Evaluation

- Evaluate the assignment sheets. See the evaluation criteria listed at the top of each assignment sheet as well as the teacher page "Answers to Assignment Sheets."

- Give the written test. See the teacher page "Written Test."

- Evaluate the written test. See the teacher page "Answers to Written Test."

- Compile written-test and assignment-sheet scores. See the teacher page "Unit Evaluation Form."

- Reteach and retest as required.

Suggested resources

Resources used in developing this unit

Print media

- Graf, Rudolf F., and George J. Whalen. *VNR Illustrated Guide to Power Tools.* New York: Van Nostrand Reinhold Company, 1978.

- *Outdoor Power Equipment Repair.* Stillwater, Oklahoma: Mid-America Vocational Curriculum Consortium, 1985.

- *Power Tools and Equipment.* Alexandria, Virginia: Time-Life Books, Inc., 1989.

Suggested Activities

- *Riding Lawn Mower Service Manual,* 3rd ed. Overland Park, Kansas: Intertec Publishing Corporation, 1989.

Suggested supplemental resources

Print media

- *Outdoor Power Equipment* magazine. Adams/Green Industry Publishing, P.O. Box 10555, Riverton, New Jersey 08076-0555.
- *Power Equipment Trade* magazine. Hatton-Brown Publishers, Inc., P.O. Box 2268, Montgomery, Alabama 36102.
- *Technical Handbook.* Describes the makes and types of equipment produced by MTD—one of the nation's largest manufacturers. The book covers service for most equipment systems and various types of equipment. Both light- and heavy-duty equipment types are included. Available from MTD Products, Inc. Call 1-800-422-3381.
- Service manuals for systems covered in this unit.
- Parts catalogs for systems covered in this unit. Available from equipment manufacturers.

Non-print media

- *The Physical World of a Machine.* Tel-A-Train, 309 North Market Street, P.O. Box 4752, Chattanooga, Tennessee 37405, (615) 624-2628.
- *Roller Chain.* Tel-A-Train, 309 North Market Street, P.O. Box 4752, Chattanooga, Tennessee 37405, (615) 624-2628.
- *V-Belt: Proper Care.* Marshall Maintenance Productions, 529 S. Clinton Avenue, Trenton, New Jersey 08611, (800) 257-0430.
- *V-Belts.* Tel-A-Train, 309 North Market Street, P.O. Box 4752, Chattanooga, Tennessee 37405, (615) 624-2628.

Introduction to Lawn and Garden Equipment
Unit 1

Answers to Assignment Sheets

Assignment Sheet 1—Student performance should be evaluated according to the criteria listed on the assignment sheet. The answers will depend upon the equipment selected by the instructor.

Assignment Sheet 2—Student performance should be evaluated according to the criteria listed on the assignment sheet. The answers will depend upon the equipment selected by the instructor.

Introduction to Lawn and Garden Equipment
Unit 1

Answers to Written Test

1. Power product equipment used to care for and maintain cultivated areas and the borders between cultivated areas and structures such as sidewalks, yards, drives, and patios

2. a. Type of lawn and garden equipment that is intended for residential use, is either walked behind or carried by the operator, and is not capable of transporting the operator

   b. Type of lawn and garden equipment that is intended for agricultural, commercial, or industrial use and can either travel under its own power and transport the operator or must be carried by two or more people

3. a. Used to cut grass to a specific height

   b. Used to cut grass along the edges of sidewalks, patios, and other surfaces that are relatively the same level as the base of the lawn

   c. Used to cut grass and weeds along vertical surfaces such as building foundations and trees and on surfaces that are too rough or at angles that are too dangerous for lawn mowers

   d. Used to break up lawn thatch and to lift it from the base of the living grass

   e. Used to create a strong stream of forced air the operator uses in moving leaves, grass cuttings, and other light debris to a place where the debris can be collected

   f. Used to trim small branches from and to shape hedges, shrubs, bushes, and small trees

   g. Used to remove snow from a surface and to throw the snow away from the removal area

   h. Used to provide a stream of water under pressure for washing cars, equipment, windows, and other items where the increased pressure will aid in removing dirt and grime or in reaching distant or hard-to-reach areas

4. a. Used as a self-propelled service platform for other equipment, such as mower decks, tillers, snow blowers, plows, lifts, and dirt blades

   b. Used to cut grass while providing a place for the operator to sit and control the equipment

   c. Used to break up soil in gardens and flower beds

   d. Used to break logs apart along their length

   e. Used to grind grass cuttings, leaves, branches, and limbs into small pieces that can be burned or used as mulch

Answers to Written Test

5. Answer should include any five of the following.

   - Service engine
   - Service equipment drive
   - Service drive train on self-propelled equipment
   - Maintain blades and cutters
   - Maintain filters and screens
   - Lubricate moving parts
   - Maintain control and adjustment features
   - Perform adjustments to return equipment to original specifications
   - Perform seasonal service

Introduction to Lawn and Garden Equipment
Unit 1

Written Test

Name ______________________ Score ______________

1. Define the term *lawn and garden equipment*. Write your answer on the blanks provided beside the term below.

   Lawn and garden equipment ______________________

2. Define the terms *light-duty equipment* and *heavy-duty equipment*. Write your answers on the blanks provided beside each of the following terms.

   a. **Light-duty equipment** ______________________

   b. **Heavy-duty equipment** ______________________

3. State the functions of common types of light-duty lawn and garden equipment. Write your answers on the blanks provided beside each of the types of equipment listed below.

   a. Walk-behind lawn mower ______________________

   b. Edger ______________________

Written Test

c. Trimmer

d. Dethatcher

e. Blower

f. Hedge clippers

g. Snow blower

h. Pressure washer

4. State the functions of common types of heavy-duty lawn and garden equipment. Write your answers on the blanks provided beside each of the terms below.

   a. Graden tractor

   b. Riding lawn mower

c. Tiller ______________________________

____

____

d. Log splitter ______________________________

____

____

e. Shredder ______________________________

____

____

5. List five of the typical service procedures required for lawn and garden equipment. Write your answers on the blanks provided below.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

Permission to duplicate this test is granted.

Introduction to Lawn and Garden Equipment
Unit 1

Unit Evaluation Form

Student name ______________________________ Unit rating ____________

Assignment-sheet ratings

Assignment Sheet 1—Determine Light-Duty Lawn and Garden Equipment Service Specifications and Parts Requirements Rating ______

Comments: ____

____

Assignment Sheet 2—Determine Heavy-Duty Lawn and Garden Equipment Service Specifications and Parts Requirements Rating ______

Comments: ____

____

Written-test scores

Pretest ________ Posttest ________ Other ________

Comments: ____

____

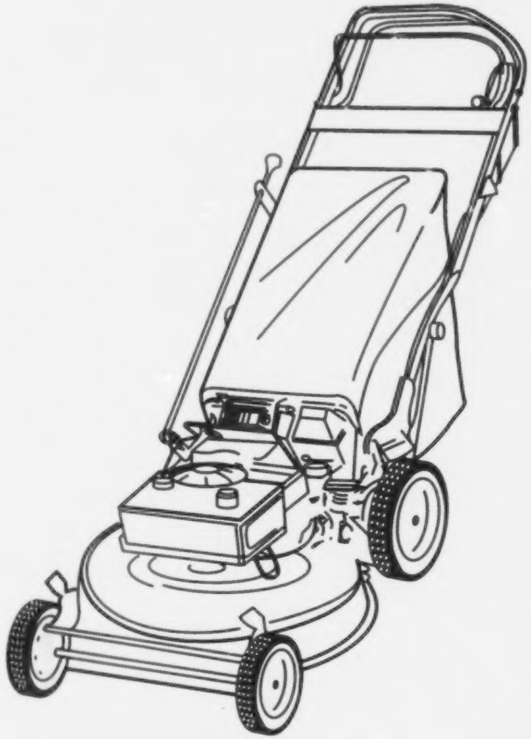
Teacher signature ______________________________ Date ____________

Student signature ______________________________ Date ____________

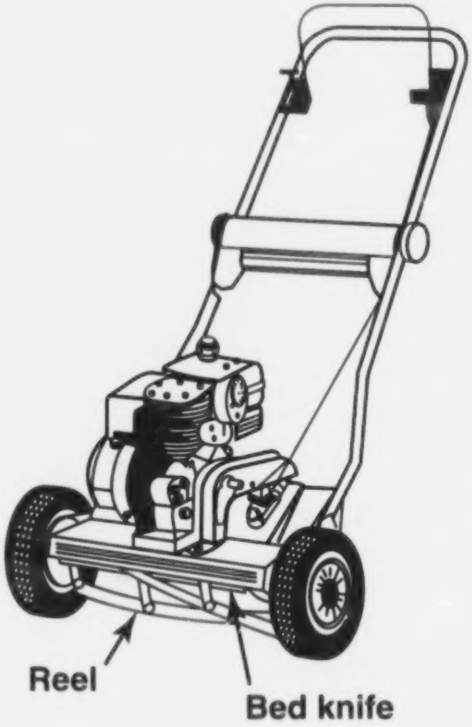
Permission to duplicate this form is granted.

Common Types of Light-Duty Equipment:

Walk-Behind Lawn Mowers



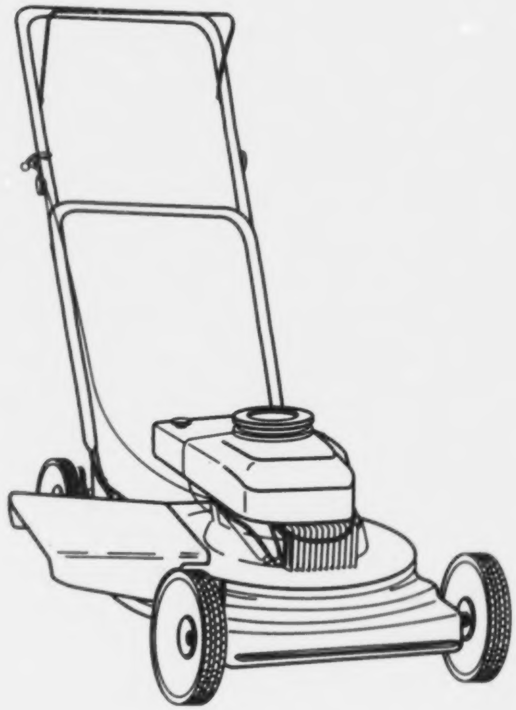
Rotary mower



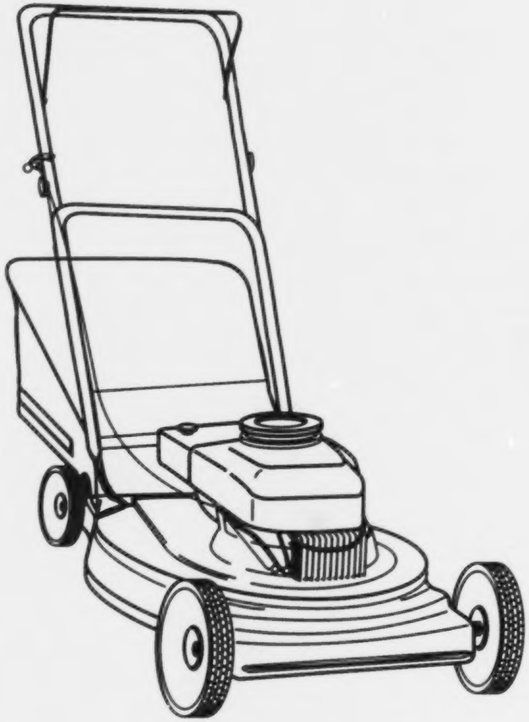
Reel mower

Common Types of Light-Duty Equipment:

Walk-Behind Lawn Mowers (continued)



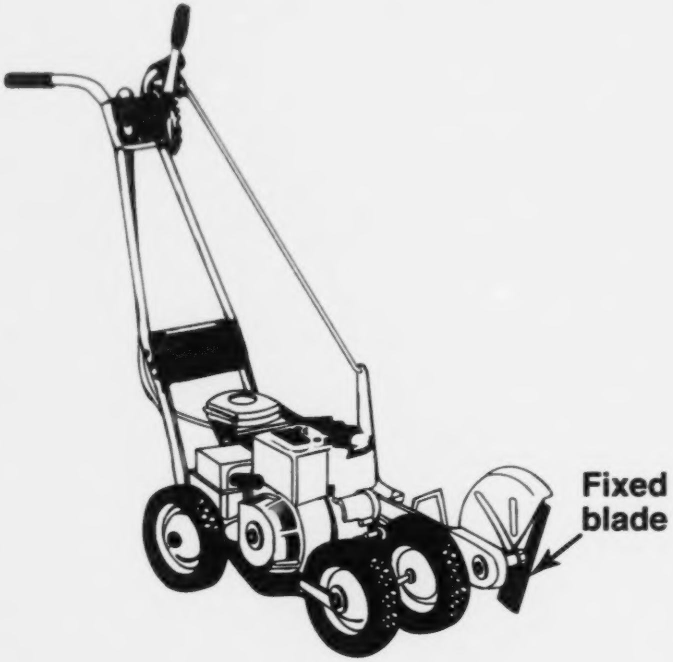
Side-discharge mower



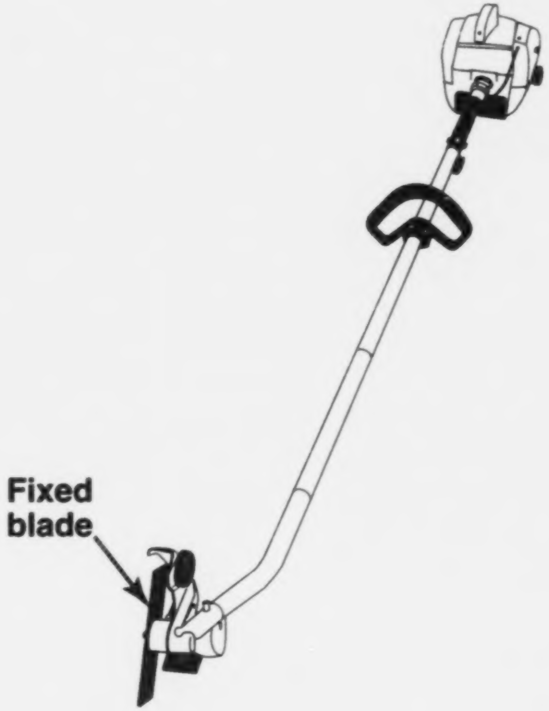
Rear-discharge mower

Common Types of Light-Duty Equipment:

Edgers


Fixed
blade

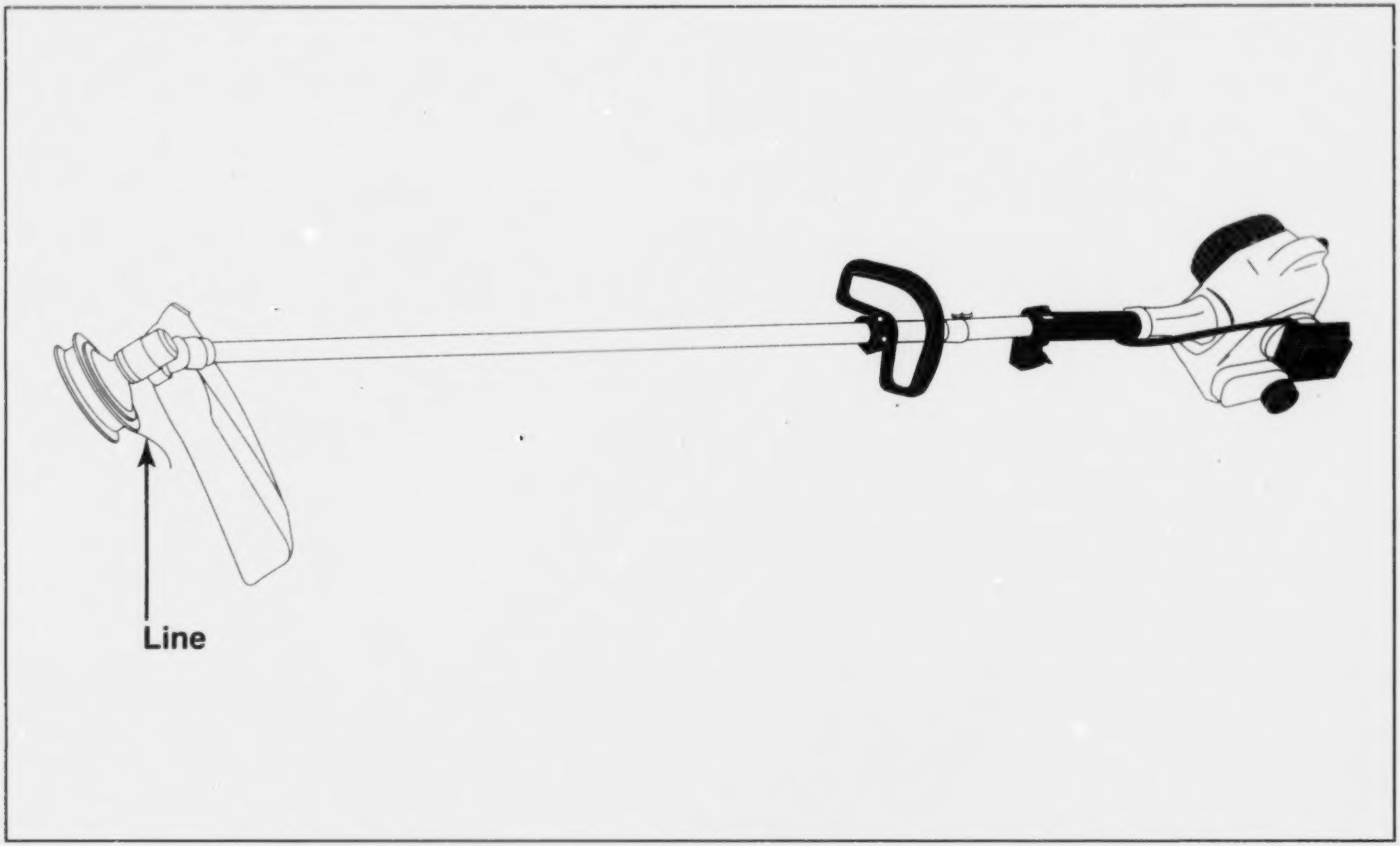
Walk-behind edger


Fixed
blade

Stick-type edger

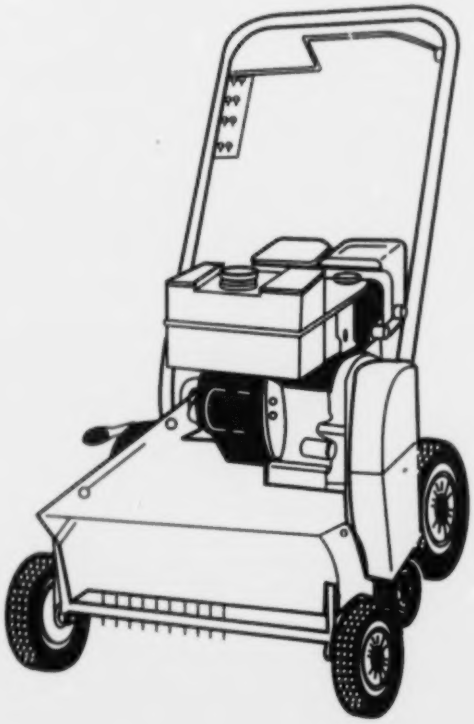
Common Types of Light-Duty Equipment:

Trimmer

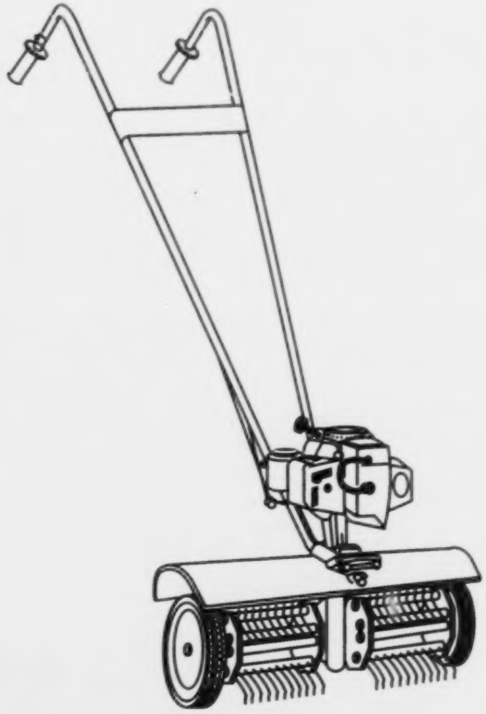


Common Types of Light-Duty Equipment:

Dethatchers



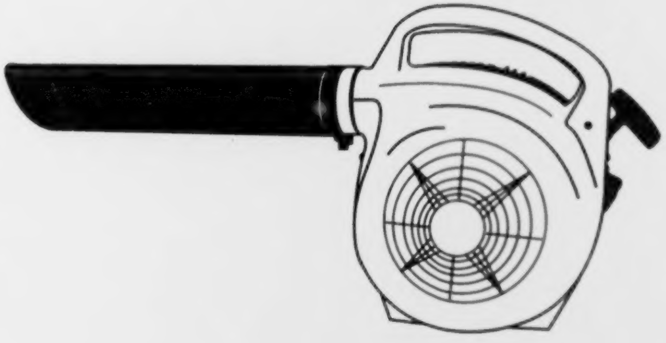
Blade dethatcher



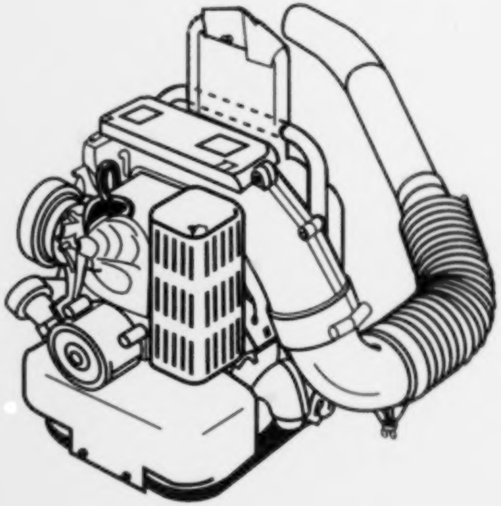
Tined dethatcher

Common Types of Light-Duty Equipment:

Blowers



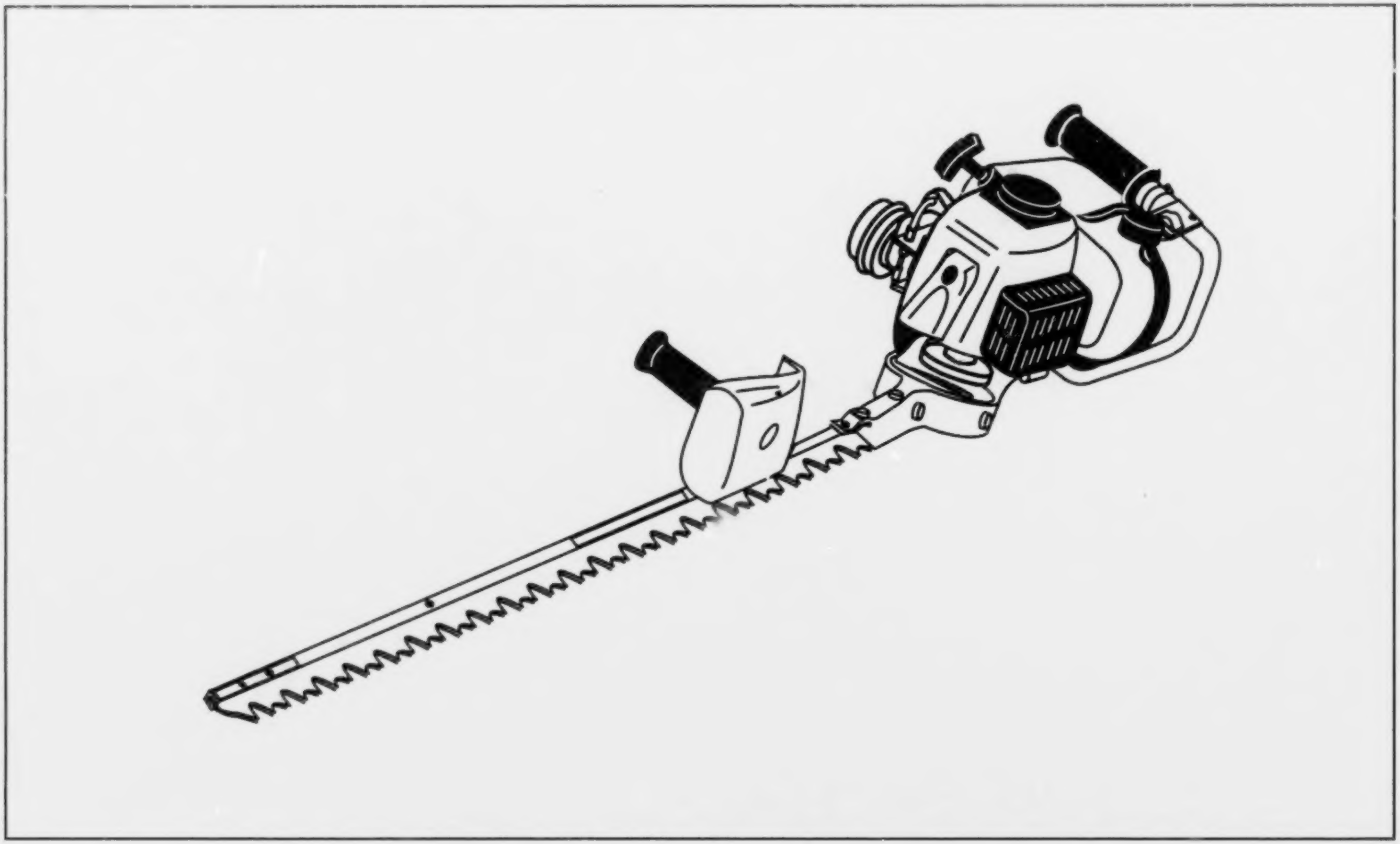
Integrated, hand-held unit



Backpack unit

Common Types of Light-Duty Equipment:

Hedge Clippers



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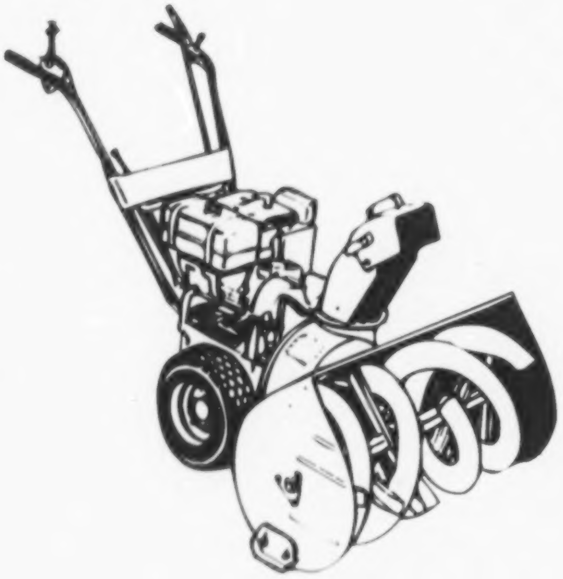
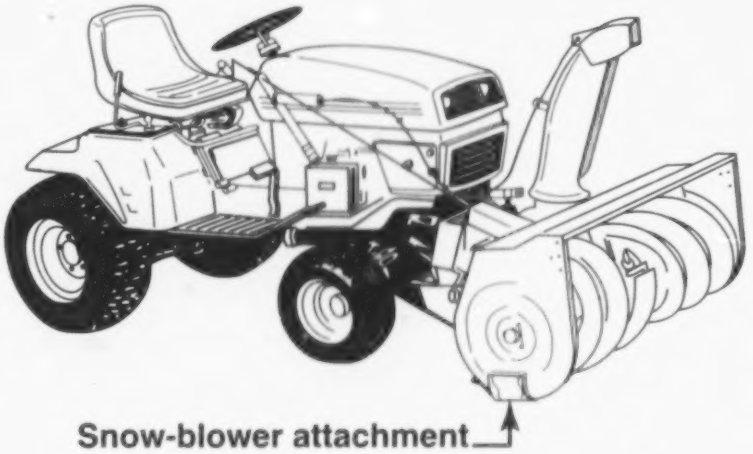
Common Types of Light-Duty Equipment:

Snow Blowers



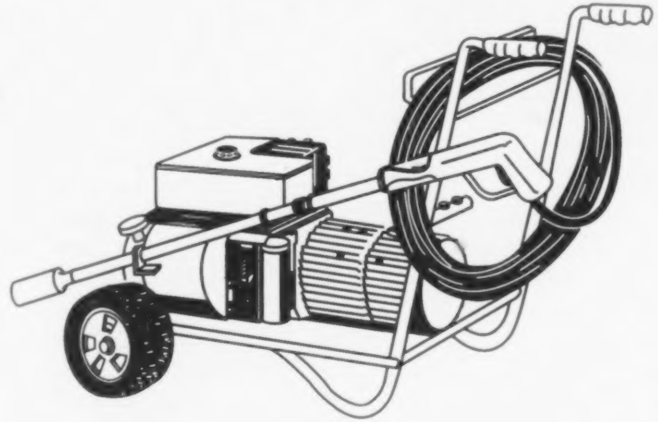
Self-powered snow blower


Snow-blower attachment

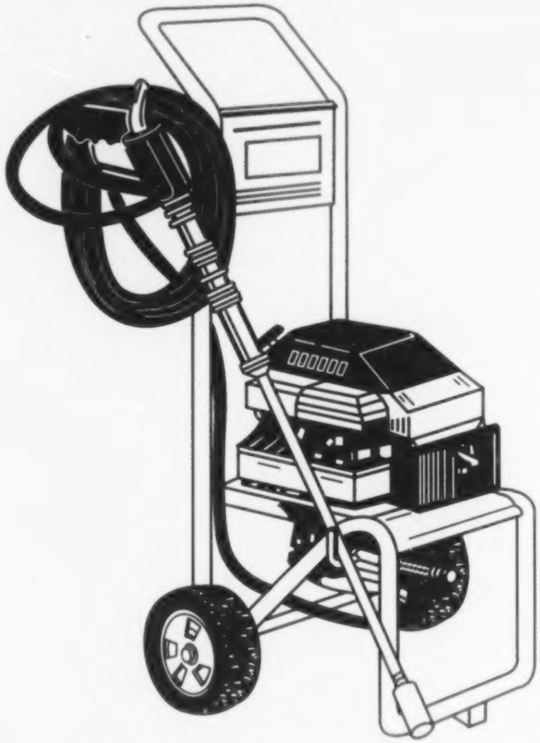
Tractor-attachment snow blower

Common Types of Light-Duty Equipment:

Pressure Washers



Wheelbarrow-type pressure washer



Dolly-type pressure washer

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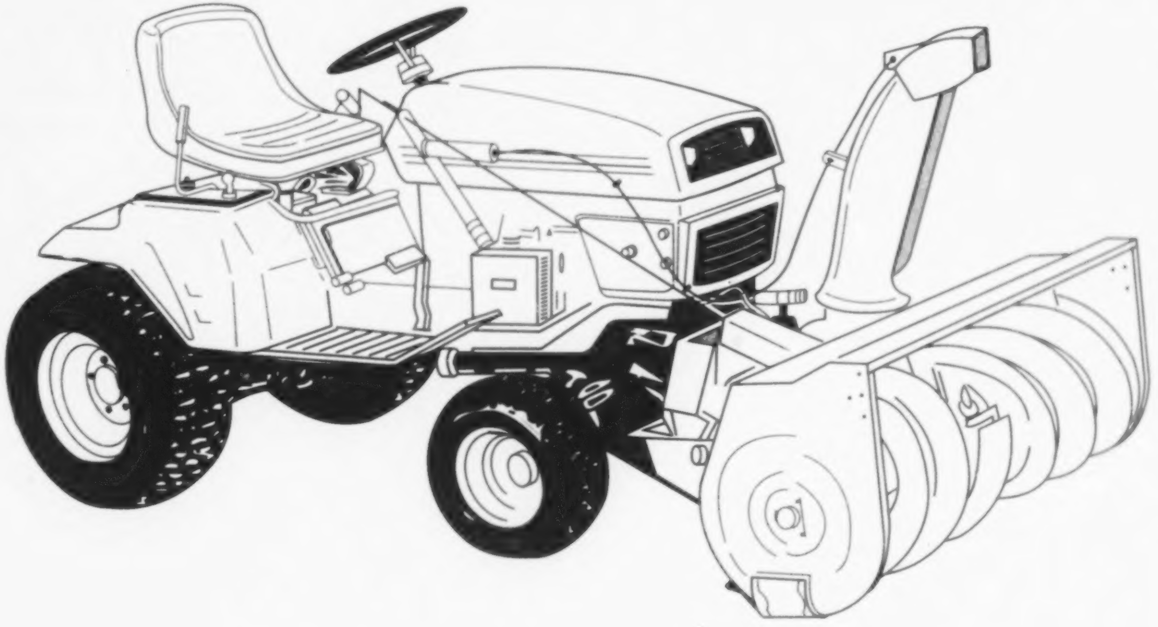
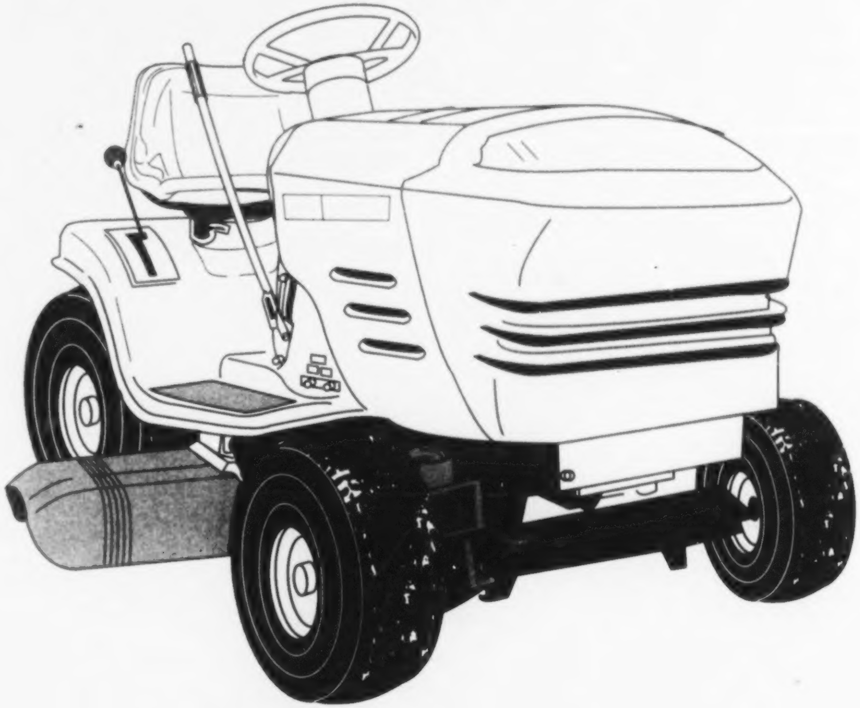
Common Types of Heavy-Duty Equipment:

Garden Tractor



Common Types of Heavy-Duty Equipment:

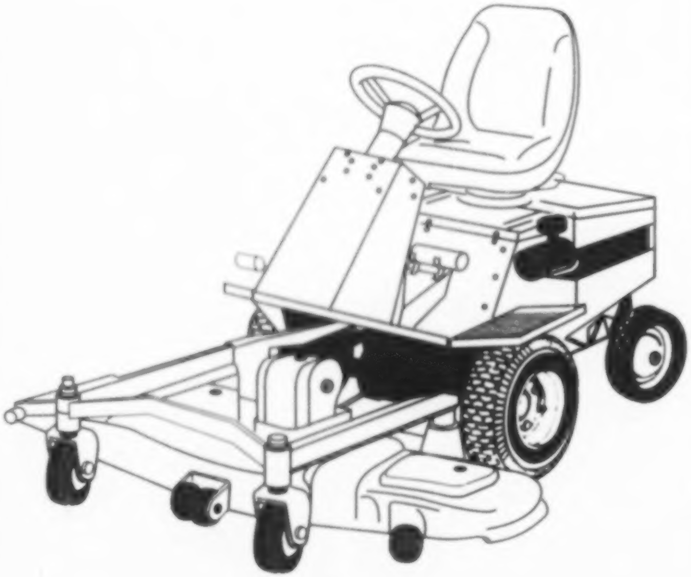
Riding Lawn Mowers



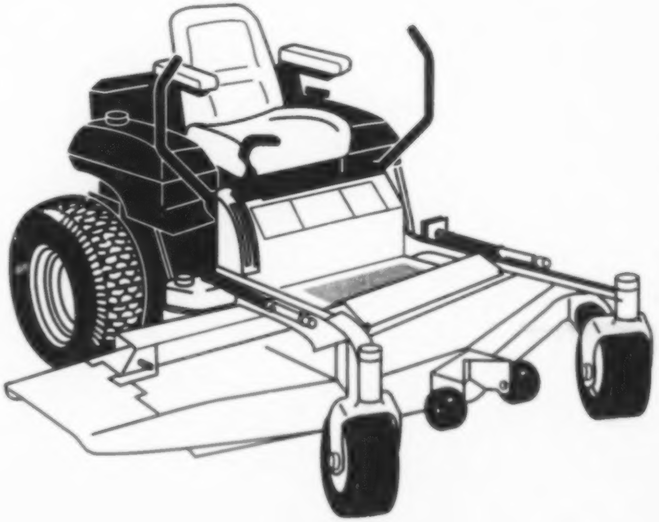
Front-engine riding lawn mower

Common Types of Heavy-Duty Equipment:

Riding Lawn Mowers (continued)



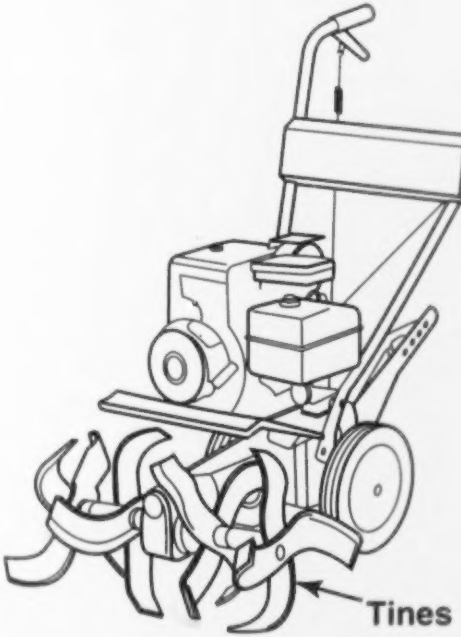
Rear-engine riding lawn mower



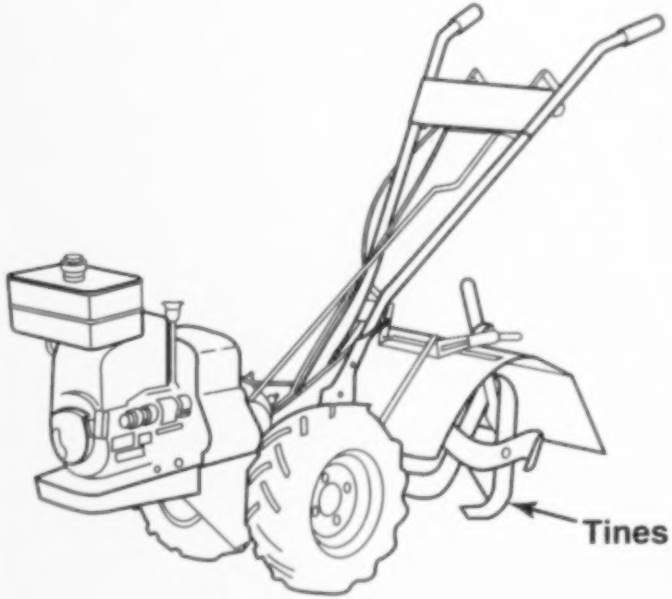
ZTR riding lawn mower

Common Types of Heavy-Duty Equipment:

Tillers



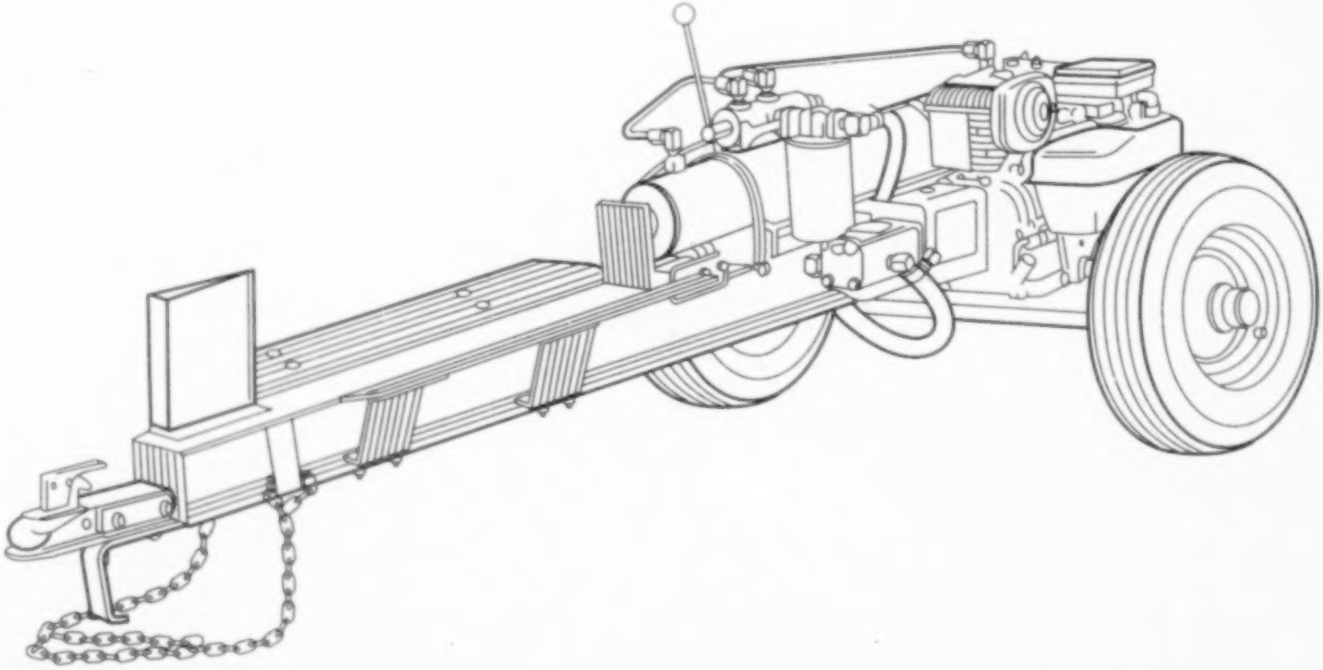
Front-tine tiller



Rear-tine tiller

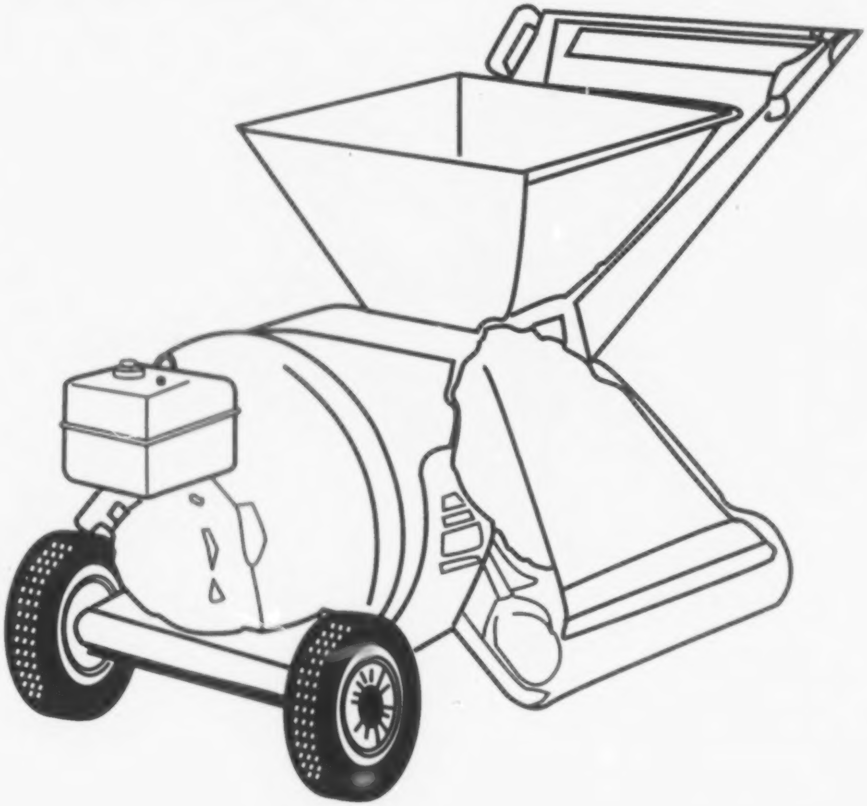
Common Types of Heavy-Duty Equipment:

Log Splitter



Common Types of Heavy-Duty Equipment:

Shredder



Light-Duty Lawn and Garden Equipment
Unit 2

Suggested Activities

Instructional plan

Preparation

- Review unit and plan presentation. Study the specific objectives to determine the order in which you will present the objectives.

  Review the unit introduction and teaching suggestions included in the delivery and application section below, and plan classroom activities. Also note suggestions for media and supplemental materials.

  Plan presentation to take advantage of student learning styles and to accommodate special-needs students.

- Prepare the classroom by displaying posters, equipment, and tools related to light-duty lawn and garden equipment.
- Make transparencies from the transparency masters included in the teacher pages of this unit.
- Select teacher components (written test, unit evaluation form) you want to distribute to your students. Copy and prepare these components for distribution.
- Review the job sheets in the student edition and locate the worksheet masters included in the teacher pages of this unit. Copy and prepare extra worksheets for distribution to your students.

Delivery and application

Unit introduction

The skill areas appearing in bold-face type in the unit introduction and teaching suggestions refer to the academic and workplace skills identified in *What Work Requires of Schools: A SCANS Report for America 2000* and *Workplace Basics: The Skills Employers Want*. These have been adapted by MAVCC.

- Provide students with copies of the student materials. You may choose to begin by discussing the objective sheet. Review the unit and specific objectives with the students. Discuss how meeting the unit objective will improve their employability or will increase their value as an employee. Explain how the specific objectives support the unit objective. **(Reading; listening; adapting to the organization's traditional modes of operation)**

Teaching suggestions

Objective 1 State safety rules for servicing light-duty lawn and garden equipment.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

Suggested Activities

- Discuss the safety rules and relate them to specific types of equipment. Invite resource persons to talk to the class about dangers related to servicing light-duty equipment. Also discuss related safety issues, such as carbon monoxide poisoning, the use of toxic chemicals for lawn and garden work, blade speeds, and other potential problems. Discuss the need to operate equipment in order to troubleshoot it and to verify service effectiveness. Use operator manuals to support discussion of safety related to specific equipment in your facility. **(Listening; reasoning; seeing things in the mind's eye; acquiring, organizing, interpreting, and processing information; system interrelationships)**

Objective 2 State the functions of the major components of walk-behind lawn mowers.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 1 to show the major components of walk-behind lawn mowers. **(Reading/listening for content)**

- Discuss the role of each component and indicate corresponding components in various designs. Show actual equipment and point out the wide variety of subsystem designs, such as different starting systems, different choke systems, throttle controls, self-propulsion systems, etc. Discuss components that require service and adjustment, such as air filters. Point out safety components, such as shutoffs. **(Listening; reasoning; applying technology; seeing things in the mind's eye; system interrelationships)**

Objective 3 List operating features used to classify walk-behind lawn mowers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Using actual equipment, show that these features can be found in a variety of combinations. For example, show models with rotary and reel blades with rear discharge paths, both manual and self-propelled versions. Exhibit a variety of blade designs. Exhibit various types of discharge bags. Discuss mulcher designs. Relate the components of various designs to their functions. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 4 Complete statements about the principles of operation of self-propelled rotary walk-behind lawn mowers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Use this objective to discuss the overall operation of walk-behind lawn mowers. A self-propelled mower is used because it is a more complex design. Trace the flow of power through the equipment. Demonstrate operation from starting through discharge. Discuss how the grass is raised for cutting and how the airstream is used to create a discharge force. Discuss service and adjustment requirements. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 5 Complete statements about the principles of operation of self-propelled reel walk-behind lawn mowers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Build on the previous objective to provide the same type of discussion about reel-type mowers. Ensure that students understand the cutting action of reel blade, which can be illustrated through the use of a manual rather that a power mower. Discuss the flow of air through a reel-type mower and exhibit discharge options. Have the students operate both rotary and reel mowers and have them discuss what they like and dislike about each type. Ask them to consider what design features contribute to their feelings about each type. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 6 List typical service procedures required for walk-behind lawn mowers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate the listed procedures and relate them to the job sheets. Indicate those procedures that are specific to particular mower designs. Emphasize procedures and equipment that are common in your geographical region. Provide service manuals for the equipment being considered. Allow students to manipulate tools and parts. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Job Sheet 1 Perform routine maintenance on lawn mowers.

- Have students locate Job Sheet 1 and the worksheet associated with the job sheet. Demonstrate the procedures for performing routine maintenance on a lawn mower. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with lawn mowers that require routine maintenance and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 1.

Job Sheet 2 Repair lawn mowers.

- Have students locate Job Sheet 2 and the worksheet associated with the job sheet. Demonstrate the procedures for repairing a lawn mower. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

Suggested Activities

- Provide students with lawn mowers that require repair and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 2.

Objective 7 State the functions of the major components of edgers.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 2 to show the major components of edgers. **(Reading/listening for content)**

- Display a number of different edgers. Include some of the newer models that integrate multiple devices into one piece of equipment, such as edgers, trimmers, tree saws, etc. Discuss the role of major components in the functioning of the equipment. Demonstrate adjustments of height, head angle, etc. Exhibit both blade and string trimmers. **(Listening; reasoning; science; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 8 State the operating features used to classify edgers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Use actual equipment to provide examples of both types of edgers. Have students brainstorm the advantages and disadvantages of each type based on utility, service requirements and upkeep, ease of use, etc. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 9 Complete statements about the principles of operation of edgers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate the operation of edgers. Use a variety of designs. Provide actual examples of each type of edger. Discuss advantages and disadvantages of each type as related to specific applications. Note similarities and differences as compared to dedicated units versus integrated units. **(Listening; reasoning; seeing things in the mind's eye; acquiring, organizing, interpreting, and processing information; system interrelationships)**

Objective 10 List typical service procedures required for edgers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate each type of service procedure. Use equipment and procedures that are common to your region. Emphasize equipment in your facility. Provide service manuals and tools required for these procedures. Allow students to manipulate tools and parts required for the procedures. Relate the procedures to the job sheets. **(Listening;**

reasoning; seeing things in the mind's eye; acquiring, organizing, interpreting, and processing information; system interrelationships)

Job Sheet 3 Perform routine maintenance on edgers.

- Have students locate Job Sheet 3 and the worksheet associated with the job sheet. Demonstrate the procedures for performing routine maintenance on an edger. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with edgers that require routine maintenance and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 3.

Job Sheet 4 Repair edgers.

- Have students locate Job Sheet 4 and the worksheet associated with the job sheet. Demonstrate the procedures for repairing an edger. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with edgers that require repair and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 4.

Objective 11 State the functions of the major components of trimmers.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 3 to show the major components of trimmers. **(Reading/listening for content)**

- Use actual equipment to point out the major components. Display a variety of designs, including those that incorporate different functions. Note similarities and differences as compared to edgers and other types of power product equipment. **(Listening; reasoning; seeing things in the mind's eye; acquiring, organizing, interpreting, and processing information; system interrelationships)**

Objective 12 State the operating feature used to classify trimmers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Display both types of trimmers. Compare and contrast the two. Point out common components. Discuss service procedures for both types. Have students operate both types of trimmers and discuss what they consider to be the advantages and disadvantages of each. Discuss other types of equipment that provide integrated features for various functions. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Suggested Activities

Objective 13 Complete statements about the principles of operation of trimmers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate the operation of trimmers. Allow students to operate the equipment. Discuss safety concerns. Discuss service requirements. Use operator's manuals to discuss equipment limitations. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 14 List typical service procedures required for trimmers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate the service procedures and relate them to the job sheets. Make available the tools and service manuals applicable to the procedures. Allow the students to manipulate the tools and equipment involved. Relate the procedures to those that students have already mastered. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Job Sheet 5 Perform routine maintenance on trimmers.

- Have students locate Job Sheet 5 and the worksheet associated with the job sheet. Demonstrate the procedures for performing routine maintenance on a trimmer. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with trimmers that require routine maintenance and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 5.

Job Sheet 6 Repair trimmers.

- Have students locate Job Sheet 6 and the worksheet associated with the job sheet. Demonstrate the procedures for repairing a trimmer. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with trimmers that require repair and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 6.

Suggested Activities

Objective 15 State the functions of the major components of dethatchers.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 4 to show the major components of dethatchers. **(Reading/listening for content)**

- Show a variety of dethatchers and related equipment, such as power vacuums, integrated dethatchers and shredders, dethatching attachments, power rakes, etc. Discuss corresponding components and their functions. **(Listening; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 16 List the operating features used to classify dethatchers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Use actual equipment to aid the discussion. Discuss the purpose of dethatching and related functions. Display the various types of designs. Invite a resource person to visit to talk to the class about the importance of dethatching and other lawn and garden functions performed by the equipment that the students will be servicing. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 17 Complete statements about the principles of operation of dethatchers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate the operation of various types of dethatchers and related equipment. Discuss the role of components in the operation of the system. Discuss common applications of each type of design and advantages and disadvantages of each for specific applications. Give an overview of related service procedures. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 18 List typical service procedures required for dethatchers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate the service procedures presented in the information sheet and relate them to the job sheets. Provide equipment and service manuals required to support the procedures. Relate the procedures to those covered previously. Display wall charts related to the service procedures. Emphasize those procedures that will be covered in your presentation of the job sheets and perform relevant demonstrations. Tailor the procedures to the type of equipment and tools available in your facility. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Suggested Activities

Job Sheet 7 Perform routine maintenance on dethatchers.

- Have students locate Job Sheet 7 and the worksheet associated with the job sheet. Demonstrate the procedures for performing routine maintenance on a dethatcher. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with dethatchers that require routine maintenance and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 7.

Job Sheet 8 Repair dethatchers.

- Have students locate Job Sheet 8 and the worksheet associated with the job sheet. Demonstrate the procedures for repairing a dethatcher. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with dethatchers that require repair and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 8.

Objective 19 State the functions of the major components of blowers.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 5 to show the major components of blowers. **(Reading/listening for content)**

- Display different types of blowers and correlate their comparable components to each other. Display blower attachments and discuss their roles. Discuss the purposes of blowers and how the components support those purposes. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information)**

Objective 20 List the operating feature used to classify blowers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Use actual equipment to show the different configurations of blowers. Emphasize different components used for the two types of designs. Discuss the role of each component in achieving the purpose of blowers. **(Listening; reasoning; applying technology; seeing things in the mind's eye; system interrelationships)**

Objective 21 Complete statements about the principles of operation of blowers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

Suggested Activities

- Demonstrate the operation of blowers. Emphasize safety concerns and personal protection. Trace the flow of air through the equipment. Point out control features. Relate the equipment operation to other devices that the students have studied. Review operator's manuals for each device. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 22 List service procedures required for blowers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate the service procedures and relate them to the job sheets. Make service manuals and tools available to support the service manuals. Relate the procedures to others that the students have mastered. Allow the students to manipulate tools and parts. Provide an overview of applications and associated service procedures for each type of blower. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Job Sheet 9 Perform routine maintenance on blowers.

- Have students locate Job Sheet 9 and the worksheet associated with the job sheet. Demonstrate the procedures for performing routine maintenance on a blower. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with a blower that requires routine maintenance and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 9.

Job Sheet 10 Repair blowers.

- Have students locate Job Sheet 10 and the worksheet associated with the job sheet. Demonstrate the procedures for repairing a blower. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with a blower that requires repair and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 10.

Objective 23 State the functions of the major components of hedge clippers.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 6 to show the major components of hedge clippers. **(Reading/listening for content)**

Suggested Activities

- Display various types of actual equipment and show how the components work together to achieve the required clipping action. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 24 List operating features used to classify hedge clippers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate the operation of hedge clippers. Exhibit a partially disassembled unit in order to explain the conversion of rotary motion to reciprocating motion. Show the use of gears on single- and two-stage clippers. Discuss single- and double-action cutting designs. Use this discussion to lead into the next objective. **(Listening; reasoning; science; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 25 Complete statements about the principles of operation of hedge clippers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate the operation of hedge clippers. Using the partially disassembled unit, trace power through the engine and through the cutting process. Discuss the role of gears and variability in cutting speeds. Demonstrate how double-action cutting is achieved. Discuss safety concerns and protective equipment. Allow students to operate various types of clippers and compare their performance. Have the students brainstorm service requirements and potential problems in terms of the different designs. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 26 List typical service procedures required for hedge clippers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate the procedures and relate them to the job sheets. Make the required tools and service manuals available to support the procedures. Discuss safety concerns. Relate procedures to those that students understand from previous studies. Allow students to practice the procedures. **(Listening; reasoning; seeing things in the mind's eye; acquiring, organizing, interpreting, and processing information; system interrelationships)**

Job Sheet 11 Perform routine maintenance on hedge clippers.

- Have students locate Job Sheet 11 and the worksheet associated with the job sheet. Demonstrate the procedures for performing routine maintenance on a hedge clipper. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

Suggested Activities

- Provide students with hedge clippers that require routine maintenance and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 12.

Job Sheet 12 Repair hedge clippers.

- Have students locate Job Sheet 12 and the worksheet associated with the job sheet. Demonstrate the procedures for repairing hedge clippers. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.
- Provide students with hedge clippers that require repair and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 12.

Objective 27 State the functions of the major components of snow blowers.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 7 to show the major components of snow blowers. **(Reading/listening for content)**
- Provide actual examples of various types of snow blowers. Relate their design and operation to that of garden tractors and other equipment with which the students are familiar. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 28 Match types of snow blowers to their correct descriptions.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**
- Provide actual examples of both auger and paddle and single- and two-stage designs. Discuss advantages and disadvantages of each design for specific operations, such as specific snow depths. Have the students brainstorm the impact of engine placement on other design features. Discuss the impact of engine placement on service procedures. **(Listening; reasoning; science; seeing things in the mind's eye; interpreting and processing information; system interrelationships; applying technology)**

Objective 29 Complete statements about the principles of operation of snow blowers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

Suggested Activities

- Demonstrate the operation of snow blowers of various designs. Compare the operation to other equipment with which the students are familiar. Emphasize the operation of the augers and paddles and the impeller and discharge systems. Discuss safety concerns in the operation of snow blowers. Be sure to include safety guidelines related to working in cold weather and the potential for heart attacks. Allow the students to operate the equipment. Discuss service requirements based on the design and operation of the equipment. Also discuss seasonal storage for winter equipment as opposed to equipment that is used primarily in the spring, summer, and fall. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships; applying technology)**

Objective 30 List typical service procedures required for snow blowers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate relevant service procedures. Discuss the tools, materials, techniques, and safety precautions applicable to each procedure. Discuss differences in procedures due to design, manufacturer, application, and other factors. Emphasize procedures and techniques used in your facilities. Familiarize students with the location of reference materials, tools, equipment, and other resources required for performing these service procedures. **(Listening; reasoning; seeing things in the mind's eye; acquiring, organizing, interpreting, and processing information; system interrelationships; applying technology)**

Job Sheet 13 Perform routine maintenance on snow blowers.

- Have students locate Job Sheet 13 and the worksheet associated with the job sheet. Demonstrate the procedures for performing routine maintenance on a snow blower. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with snow blowers that require routine maintenance and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 13.

Job Sheet 14 Repair snow blowers.

- Have students locate Job Sheet 14 and the worksheet associated with the job sheet. Demonstrate the procedures for repairing a snow blower. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with snow blowers that require repair and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 14.

Suggested Activities

Objective 31 State the functions of the major components of pressure washers.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 8 to show the major components of pressure washers. **(Reading/listening for content)**

- Provide actual examples of various types of pressure washers. Relate their design and operation to that of garden tractors and other equipment with which the students are familiar, emphasizing the operation of the pump as related to pumps in other types of equipment. You may even want to point out that there are sump pumps and irrigation pumps powered by engines such as those used for power product equipment. Additionally, PTO-driven pumps are available. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 32 State the operating feature used to classify pressure washers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Provide actual examples of various washer designs. Discuss advantages and disadvantages of each design for specific operations. **(Listening; reasoning; science; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 33 Complete statements about the principles of operation of pressure washers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate the operation of pressure washers of various designs. Compare the operation to equipment with which the students are familiar. Emphasize pump operations as related to hydraulic systems, for example. Discuss safety concerns in the operation of pressure washers. Allow the students to operate the equipment. Discuss service requirements based on the design and operation of the equipment. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships; applying technology)**

Objective 34 List typical service procedures required for pressure washers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

Suggested Activities

- Demonstrate relevant service procedures. Discuss the tools, materials, techniques, and safety precautions applicable to each procedure. Discuss differences in procedures due to design, manufacturer, application, and other factors. Emphasize procedures and techniques used in your facilities. Familiarize students with the location of reference materials, tools, equipment, and other resources required for performing these service procedures. **(Listening; reasoning; seeing things in the mind's eye; acquiring, organizing, interpreting, and processing information; system interrelationships; applying technology)**

Job Sheet 15 Perform routine maintenance on pressure washers.

- Have students locate Job Sheet 15 and the worksheet associated with the job sheet. Demonstrate the procedures for performing routine maintenance on a pressure washer. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with pressure washers that require routine maintenance and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 15.

Job Sheet 16 Repair pressure washers.

- Have students locate Job Sheet 16 and the worksheet associated with the job sheet. Demonstrate the procedures for repairing a pressure washer. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with pressure washers that require repair and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 16.

Evaluation

- Evaluate the job sheets.

  When the student is ready to perform a specific task, obtain a copy of the worksheet associated with each job sheet. Worksheets may be found in the student edition and in the teacher pages following the transparency masters. Then, observe the student performing the procedure.

  After the student has completed the procedure, rate the student using the criteria provided on the worksheet. If the student's performance is unacceptable, have the student review the materials and perform the procedure again for evaluation.

  Two sample performance evaluation keys are provided below. Many other keys are available. Select one evaluation key (grading scale) that best fits your program needs.

Suggested Activities

Performance Evaluation Keys

Sample A

4 — Skilled—Can perform job with no additional training.
3 — Moderately skilled—Has performed job during training program; limited additional training may be required.
2 — Limited skill—Has performed job during training program; additional training is required to develop skill.
1 — Unskilled—Is familiar with process, but is unable to perform job.

Sample B

Yes—Can perform job with no additional training.

No—Is unable to perform job satisfactorily.

- Give the written test. See the teacher page "Written Test."
- Evaluate the written test. See the teacher page "Answers to Written Test."
- Compile written-test and job-sheet scores. See the teacher page "Unit Evaluation Form."
- Reteach and retest as required.

Suggested resources

Resources used in developing this unit

Print media

- Graf, Rudolf F., and George J. Whalen. *VNR Illustrated Guide to Power Tools.* New York: Van Nostrand Reinhold Company, 1978.
- *Outdoor Power Equipment Repair.* Stillwater, Oklahoma: Mid-America Vocational Curriculum Consortium, 1985.
- *Power Tools and Equipment.* Alexandria, Virginia: Time-Life Books, Inc., 1989.
- *Riding Lawn Mower Service Manual,* 3rd ed. Overland Park, Kansas: Intertec Publishing Corporation, 1989.

Supplemental resources

Print media

- *Power Equipment Trade* magazine. Hatton-Brown Publishers, Inc., P.O. Box 2268, Montgomery, Alabama 36102.

- *Technical Handbook.* Describes the makes and types of equipment produced by MTD—one of the nation's largest manufacturers. The book covers service for most equipment systems and various types of equipment. Both light- and heavy-duty equipment types are included. Available from MTD Products, Inc. Call 1-800-422-3381.

- Service manuals for systems covered in this unit.

- Parts catalogs for systems covered in this unit. Available from equipment manufacturers.

Non-print media

- *The Physical World of a Machine.* Tel-A-Train, 309 North Market Street, P.O. Box 4752, Chattanooga, Tennessee 37405, (615) 624-2628.

- *Roller Chain.* Tel-A-Train, 309 North Market Street, P.O. Box 4752, Chattanooga, Tennessee 37405, (615) 624-2628.

- *V-Belt: Proper Care.* Marshall Maintenance Productions, 529 S. Clinton Avenue, Trenton, New Jersey 08611, (800) 257-0430.

- *V-Belts.* Tel-A-Train, 309 North Market Street, P.O. Box 4752, Chattanooga, Tennessee 37405, (615) 624-2628.

Light-Duty Lawn and Garden Equipment
Unit 2

Answers to Written Test

1. a. Remove the spark plug when performing service that does not require the engine to be running.
   b. Do not expose spilled fuel to heat or sparks from the hot equipment.
   c. Allow the equipment to cool for at least 10 minutes before filling the fuel tank, and move the equipment at least 10 feet from the site of refueling.
   d. Do not operate equipment when the guards, shields, or other safety features have been removed.
   e. Do not operate equipment that is under excessive load.
   f. Never direct operating equipment so that forced air or debris discharge could reach another person.

2. a. Allows the operator to push and turn the mower and may support various controls
   b. Allows the operator to control engine speed
   c. Prevents the engine from running when the component is not engaged
   d. Provides rotary power to the blade and, in some designs, to the drive wheels
   e. Supports the engine
   f. Cuts the grass and produces the forced air necessary to discharge the grass cuttings
   g. Directs the airflow that discharges the grass cuttings
   h. Support the engine and the deck and allow the mower to move over surfaces to be mowed

3. a. Rotary or reel
   b. Side discharge or rear discharge
   c. Pushed or self-propelled

4. a. perpendicular; mower deck
   b. chain; belt; friction wheel
   c. handlebar

5. a. parallel; bed knife
   b. friction wheel; geared wheel; chain; belt
   c. handlebar

6. Answer should include any seven of the following.

- Sharpen blade or bed knife
- Balance blade
- Maintain oil level
- Change oil
- Clean filter
- Replace filter
- Maintain spark plug
- Service ignition system
- Service fuel system

Answers to Written Test

- Lubricate wheels and chassis components
- Inspect and service safety systems
- Service starter system
- Adjust mower height
- Service self-propelled system, if mower is so equipped

7. a. Allow the operator to guide the edger and may support various controls
   b. Controls the throttle setting, which controls the engine speed
   c. Provides the rotary power to power the blade
   d. Supports the blade
   e. Cuts the grass
   f. Support the engine on walk-behind edgers and allow an edger to be moved over the surfaces to be edged

8. a. Walk-behind or carried, stick-type design
   b. Fixed head or rotating head

9. a. blade; blade
   b. handles

10. Answer should include any six of the following.

- Sharpen blade
- Balance blade
- Maintain oil level
- Change oil
- Clean filter
- Replace filter
- Maintain spark plug
- Service ignition system
- Service fuel system
- Lubricate wheels and chassis components on walk-behind models
- Inspect and service safety systems
- Service starter system

11. a. Allow the operator to guide the trimmer and may contain some trimmer controls
    b. Controls the throttle setting, which controls engine speed
    c. Provides the rotary power to power the blade or line
    d. Cuts the grass or vegetation

12. Line or blade

13. a. rotary; shaft; blade; monofilament line
    b. handles

Answers to Written Test

14. Answer should include any seven of the following.

    - Sharpen blade
    - Balance blade
    - Replace line
    - Maintain oil level
    - Change oil
    - Clean filter
    - Replace filter
    - Maintain spark plug
    - Service ignition system
    - Service fuel system
    - Lubricate and service drive shaft
    - Inspect and service safety systems
    - Service starter system
    - Service exhaust system

15. a. Provides the power to drive the dethatcher mechanism and, in some designs, to drive the wheels
    b. Supports the engine and other components
    c. Allows the operator to adjust the engine speed
    d. Allows the operator to push the dethatcher and guide its movement
    e. Support the dethatcher and allow it to travel over the surfaces to be groomed
    f. Lifts thatch, leaves, grass clippings, and other debris from the lawn

16. a. Lawn vacuum or dethatcher
    b. Dedicated unit or accessory

17. a. belt; chain; tines; impeller; rear; side
    b. impeller; rear; side

18. Answer should include any six of the following.

    - Inspect and replace dethatcher reel
    - Inspect and replace impeller
    - Inspect and replace drive mechanism
    - Adjust drive mechanism
    - Maintain oil level
    - Change oil
    - Clean air filter
    - Change air filter
    - Maintain spark plug
    - Service ignition system
    - Service fuel system
    - Inspect and service safety systems
    - Service starter system

Answers to Written Test

19. a. Provides the rotary power to drive the blower fan
    b. Allows air to enter the blower housing
    c. Draws air into the blower housing and exhausts the air with force
    d. Allows air to exit the blower housing
    e. Allows the operator to direct the air to the desired location

20. Integrated, hand-held unit or backpack unit

21. a. rotary; blower fan; rotating fan; exhaust port; nozzle
    b. nozzle

22. Answer should include any six of the following.

- Service blower fan
- Check output force
- Maintain oil level
- Change oil
- Clean filter
- Replace filter
- Maintain spark plug
- Service ignition system
- Service fuel system
- Inspect and service safety systems
- Service starter system

23. a. Allow the operator to hold and control the hedge clippers
    b. Provides the rotary power
    c. Moves back and forth to provide the cutting action
    d. Provides a fixed cutting surface

24. a. Single action or double action
    b. Single stage or two stage

25. a. shaft; shaft; crank; cam; reciprocating blade; reciprocating blade; fixed blade; fixed blade; reciprocating blade
    b. handles

26. Answer should include any six of the following.

- Sharpen blade
- Service reciprocating blade
- Maintain oil level
- Change oil
- Clean filter
- Replace filter
- Maintain spark plug
- Service ignition system
- Service fuel system
- Inspect and service safety systems
- Service starter system

Answers to Written Test

27.
a. Allow the operator to guide the equipment movement
b. Provide control over the operating parts
c. Provides the power to the equipment drive and the drive train, if so equipped
d. Provides the exit for the snow
e. Creates the airflow from the auger through the discharge chute and breaks up the snow
f. Breaks up the snow and moves it toward the impeller
g. Helps to contain the snow as the auger moves the snow toward the impeller
h. Supports the auger housing on snow and ice
i. Supports the equipment and allows it to be moved easily

28.
a. 2
b. 3
c. 1
d. 4

29. **Single stage**

a. paddles; auger
b. paddles, auger
c. paddle
d. auger
e. traction wheel; drive axle; traction wheel; traction disc

Two stage

a. auger; impeller
b. auger; auger housing
c. impeller
d. traction wheel; drive axle; traction wheel; traction disc
e. Electric

30. Answer should include any four of the following.

- Service engine
- Service drive train
- Service starter
- Service equipment drive
- Service chassis
- Inspect and replace auger or paddles
- Inspect and replace impeller
- Service discharge chute

31.
a. Provides the power to the pump
b. Allows the water to enter the pump
c. Pressurizes the water
d. Allows the pressurized water to exit the pump
e. Transports the pressurized water to the nozzle and allows the operator to spray water at a distance from the washer
f. Regulates the water spray pattern and allows the operator to open or close the water flow
g. Supports the engine, pump, and other components and allows the operator to move the unit

Answers to Written Test

32. Dolly design or wheelbarrow design

33.
    a. tap; tank
    b. engine-output shaft
    c. outlet
    d. nozzle
    e. unloader valve
    f. nozzle; nozzle; inlet

34. Answer should include any four of the following.

- Service engine
- Service pump
- Replace seals
- Replace or clean filter
- Replace hose or nozzle
- Replace relief valve
- Service, repair, or replace unloader valve

Light-Duty Lawn and Garden Equipment
Unit 2

Written Test

Name ______________________________ Score ______________

1. State safety rules for servicing light-duty lawn and garden equipment. Write the complete safety rule on the blanks provided beside each of the terms below.

   a. Spark plug ______________________________

   ____

   b. Spilled fuel ______________________________

   ____

   c. Equipment cooling ______________________________

   ____

   d. Safety features ______________________________

   ____

   e. Equipment under load ______________________________

   ____

   f. Directing operating equipment ______________________________

   ____

2. State the functions of the major components of walk-behind lawn mowers. Write your answers on the blanks provided beside each of the terms below.

   a. Handlebar ______________________________

   ____

   ____

   b. Throttle control ______________________________

   ____

   ____

   c. Blade-brake lever ______________________________

   ____

   ____

d. Engine ____

____

____

e. Deck ____

____

____

f. Blade ____

____

____

g. Discharge chute ____

____

____

h. Tire and wheel assemblies ______________________________

____

____

3. List operating features used to classify walk-behind lawn mowers. Write your answers on the blanks provided beside each of the terms below.

   a. Type of blade ____________________________________

   b. Discharge path ___________________________________

   c. Drive-power source ________________________________

4. Complete statements about the principles of operation of self-propelled rotary walk-behind lawn mowers. Write the missing word(s) on the blanks provided in the following statements.

   a. Power from the engine causes the blade to rotate with an axis of rotation that is ______________ to the ground; the rotation of the blade cuts the grass and causes air to circulate under the ______________; the circulating air carries the grass cuttings until they are discharged at the discharge chute.

   b. Power from the engine is transferred to a drive axle, usually by a ______________ or a ______________, or in some designs, by a ______________.

   c. The operator controls the movement of the mower by using the ______________.

5. Complete statements about the principles of operation of self-propelled reel walk-behind lawn mowers. Write the missing word(s) on the blanks provided in the following statements.

   a. Power from the engine causes the blade to rotate with an axis of rotation that is ________________ to the ground; the rotation of the blade causes air to circulate and pulls the grass into the ________________, which cuts the grass; the circulating air carries the grass cuttings past the bed knife until they are discharged at the rear of the mower.

   b. Power from the engine is transferred to a drive axle, usually by a ________________ or a ________________, or in some designs, by a ________________ or a ________________.

   c. The operator controls the movement of the mower by using the ________________.

6. List seven of the typical service procedures required for walk-behind lawn mowers. Write your answers on the blanks provided below.

   a. ____

   b. ____

   c. ____

   d. ____

   e. ____

   f. ____

   g. ____

7. State the functions of the major components of edgers. Write your answers on the blanks provided beside each of the terms below.

   a. Handles ____

   ____

   b. Throttle control ____

   ____

   c. Engine ____

   ____

   d. Cutting head ____

   ____

   e. Blade ____

   ____

   f. Tire and wheel assemblies ____

   ____

8. State the operating features used to classify edgers. Write your answers on the blanks provided beside the terms below.

   a. Operating configuration ____

   b. Cutting-head design ____

9. Complete statements about the principles of operation of edgers. Write the missing word(s) on the blanks provided in the following statements.

   a. Power from the engine causes the ____________________ to rotate; the ____________________ cuts the grass, which falls outside the cutting head.

   b. The operator controls the movement of the edger by using the ____________________.

10. List six of the typical service procedures required for edgers. Write your answers on the blanks provided below.

    a. ____

    b. ____

    c. ____

    d. ____

    e. ____

    f. ____

11. State the functions of the major components of trimmers. Write your answers on the blanks provided beside each of the terms below.

    a. Handles ____

    b. Throttle control ____

    c. Engine ____

    d. Line or blade ____

Written Test

12. State the operating feature used to classify trimmers. Write your answer on the blank provided beside the term below.

    Cutting mechanism ______________________________

13. Complete statements about the principles of operation of trimmers. Write the missing word(s) on the blanks provided in the following statements.

    a. The engine provides ____________ power that drives a ____________ to which the cutting mechanism—a ____________ or spool and ____________—is attached; the rotation of the cutting mechanism cuts the grass and vegetation at the height chosen by the operator.

    b. The operator controls the movement of the trimmer by using the ____________ to guide the trimmer back and forth over the surface to be trimmed.

14. List seven of the typical service procedures required for trimmers. Write your answers on the blanks provided below.

    a. ______________________________
    b. ______________________________
    c. ______________________________
    d. ______________________________
    e. ______________________________
    f. ______________________________
    g. ______________________________

15. State the functions of the major components of dethatchers. Write your answers on the blanks provided beside each of the terms below.

    a. Engine ______________________________
    ____
    b. Deck ______________________________
    ____
    c. Throttle control ______________________________
    ____
    d. Handle ______________________________
    ____

e. Tire and wheel assemblies ______________________________

____

f. Dethatcher mechanism ______________________________

____

16. List the operating features used to classify dethatchers. Write your answers on the blanks provided beside the terms below.

a. Type of work mechanism ______________________________

b. Configuration ______________________________

17. Complete statements about the principles of operation of dethatchers. Write the missing word(s) on the blanks provided in the following statements.

a. **Dethatchers**—The power of the engine drives a ______________ or a ______________ that causes the dethatcher reel to rotate; the ______________ on the reel cut through the thatch and break it into small pieces; the engine also powers an ______________ that creates a low-pressure area under the deck of the dethatcher so that the loosened thatch is carried into the low-pressure area; the momentum of the moving debris carries it past the low-pressure area into the discharge stream, either to the ______________ or to one ______________ of the equipment.

b. **Lawn vacuums**—The engine powers an ______________ that creates a low-pressure area under the deck of the equipment so that leaves, grass clippings, and other light debris are carried into the low-pressure area; the momentum of the moving debris carries it past the low-pressure area into the discharge stream, either to the ______________ or to one ______________ of the equipment.

18. List six of the typical service procedures required for dethatchers. Write your answers on the blanks provided below.

a. ____

b. ____

c. ____

d. ____

e. ____

f. ____

Written Test

19. State the functions of the major components of blowers. Write your answers on the blanks provided beside each of the terms below.

    a. Engine ____

    ____

    b. Air-intake port ____

    ____

    c. Blower fan ____

    ____

    d. Exhaust port ____

    ____

    e. Nozzle ____

    ____

20. List the operating feature used to classify blowers. Write your answer on the blank provided beside the term below.

    Blower configuration ____

21. Complete statements about the principles of operation of blowers. Write the missing word(s) on the blanks provided in the following statements.

    a. The engine provides ______________ power to drive the ______________; the ______________ produces a flow of air; the airflow is directed out of the ______________ and into the ______________, which creates a restriction and increases the speed of the airflow.

    b. The operator directs the airflow from the blower by directing the ______________ to a desired location.

22. List six of the typical service procedures required for blowers. Write your answers on the blanks provided below.

    a. ____
    b. ____
    c. ____
    d. ____
    e. ____
    f. ____

Written Test

23. State the functions of the major components of hedge clippers. Write your answers on the blanks provided beside each of the terms below.

    a. Handles ____

    ____

    b. Engine ____

    ____

    c. Reciprocating blade ____

    ____

    d. Fixed blade ____

    ____

24. List the operating features used to classify hedge clippers. Write your answers on the blanks provided beside the terms below.

    a. Cutting action ____

    b. Gear arrangement ____

25. Complete statements about the principles of operation of hedge clippers. Write the missing word(s) on the blanks provided in the following statements.

    a. Power from the engine causes a ______________ to rotate; the rotating ______________ is connected to a reciprocating mechanism—usually a ______________ or ______________—that is connected to the ______________ with a series of teeth on each side; the ______________ rides in guides attached to the ______________, which also has a series of teeth on each side; leaves and small branches are caught between the teeth of the ______________ and ______________ and are sheared off by the reciprocating action.

    b. The operator controls the movement of the hedge clippers by using the ______________.

Written Test

26. List six of the typical service procedures required for hedge clippers. Write your answers on the blanks provided below.

    a. ______
    b. ______
    c. ______
    d. ______
    e. ______
    f. ______

27. State the functions of the major components of snow blowers. Write your answers on the blanks provided beside each of the terms below.

    a. Handlebars ______
    b. Controls ______
    c. Engine ______
    d. Discharge chute ______
    e. Impeller ______
    f. Auger ______
    g. Auger housing ______
    h. Skid ______
    i. Tire and wheel assembly ______

Written Test

28. Match types of snow blowers to their correct descriptions. Write the numbers on the blanks.

________ a. Equipment designed for snowfalls of up to approximately 14 inches; generally equipped with an engine in the 3- to 5-horsepower range that rotates an auger to force snow through a discharge chute and that may also propel the equipment

________ b. Equipment designed for snowfalls of 3 feet or more; generally equipped with an engine in the 5- to 10-horsepower range that rotates a slow-turning auger that feeds snow back to a high-speed discharge impeller; usually self-propelled and often equipped with multiple-speed transmissions

________ c. Equipment designed for snowfalls of 4 inches or less; generally equipped with an engine of 2 horsepower or less that rotates paddles to propel the scooped snow through vanes

________ d. Equipment that is powered by a garden tractor or similar equipment

1. Paddle-type, single-stage
2. Auger-type, single-stage
3. Auger-type, two-stage
4. Tractor attachment

29. Complete statements about the principles of operation of snow blowers. Write the missing word(s) on the blanks provided in the following statements.

- **Single stage**

a. The engine drives the ____________________ or the ____________________.

b. As the operator pushes the snow blower, the ____________________ or the ____________________ break up the snow.

c. With ____________________ designs, the snow is moved in chunks and thrown against deflector vanes that direct the snow to the left, right, or forward.

d. With ____________________ designs, the snow is moved to the center of the auger where a disc that turns with the auger directs snow out a discharge chute, which is adjustable to the left, right, or forward.

e. For self-propelled models, a ____________________ is generally used to transfer power to a ____________________, with speed and direction adjusted by the position of the ____________________ and the use of a second ____________________ to provide reverse.

- **Two stage**

  a. The engine drives the ________________ at a low speed and the ________________ at a high speed.

  b. As the operator pushes the snow blower, the ________________ breaks up the snow and forces it to the center of the ________________.

  c. Snow is forced through the ________________ and blown out the discharge chute, which can be directed left, right, or forward.

  d. For self-propelled models, a ________________ is generally used to transfer power to a ________________, with speed and direction adjusted by the position of the ________________ and the use of a second ________________ to provide reverse.

  e. ________________ starters are used with many models.

30. List four of the typical service procedures required for snow blowers. Write your answers on the blanks provided below.

  a. ____

  b. ____

  c. ____

  d. ____

31. State the functions of the major components of pressure washers. Write your answers on the blanks provided beside each of the terms below.

  a. Engine ____

  ____

  b. Water inlet ____

  ____

  c. Pump ____

  ____

  d. Water outlet ____

  ____

e. Hose ____

____

f. Nozzle ____

____

g. Frame ____

____

32. State the operating feature used to classify pressure washers. Write your answer on the blank provided beside the term below.

Frame configuration ____

33. Complete statements about the principles of operation of pressure washers. Write the missing word(s) on the blanks provided in the following statements.

a. Water from a source, such as a ________________ or ________________, enters the pump.

b. The engine drives the pump, often directly off the ________________.

c. The pump pressurizes the water and forces it through the ________________.

d. With the ________________ closed, pressure continues to build until the pump reaches its maximum pressure.

e. At the maximum pressure, no additional water enters the pump and the ________________ opens to allow water to recirculate in the pump.

f. If the ________________ is opened, pressurized water is released from the ________________ and water is allowed to enter the pump through the ________________.

34. List four of the typical service procedures required for pressure washers. Write your answers on the blanks provided below.

a. ____

b. ____

c. ____

d. ____

Permission to duplicate this test is granted.

Light-Duty Lawn and Garden Equipment
Unit 2

Unit Evaluation Form

Student name ______________________ Unit rating ____________

Job-sheet ratings

Job Sheet 1—Perform Routine Maintenance on Lawn Mowers Rating ______

Comments: ______________________

Job Sheet 2—Repair Lawn Mowers Rating ______

Comments: ______________________

Job Sheet 3—Perform Routine Maintenance on Edgers Rating ______

Comments: ______________________

Job Sheet 4—Repair Edgers Rating ______

Comments: ______________________

Job Sheet 5—Perform Routine Maintenance on Trimmers Rating ______

Comments: ______________________

Job Sheet 6—Repair Trimmers Rating ______

Comments: ______________________

Job Sheet 7—Perform Routine Maintenance on Dethatchers Rating ______

Comments: ______________________

Unit Evaluation Form

Job Sheet 8—Repair Dethatchers Rating ________

Comments: ____

____

Job Sheet 9—Perform Routine Maintenance on Blowers Rating ________

Comments: ____

____

Job Sheet 10—Repair Blowers Rating ________

Comments: ____

____

Job Sheet 11—Perform Routine Maintenance on Hedge Clippers Rating ________

Comments: ____

____

Job Sheet 12—Repair Hedge Clippers Rating ________

Comments: ____

____

Job Sheet 13—Perform Routine Maintenance on Snow Blowers Rating ________

Comments: ____

____

Job Sheet 14—Repair Snow Blowers Rating ________

Comments: ____

____

Job Sheet 15—Perform Routine Maintenance on Pressure Washers Rating ________

Comments: ____

____

Job Sheet 16—Repair Pressure Washers Rating ________

Comments: ____

____

Unit Evaluation Form

Written-test scores

Pretest ____________ Posttest ____________ Other ____________

Comments: ____

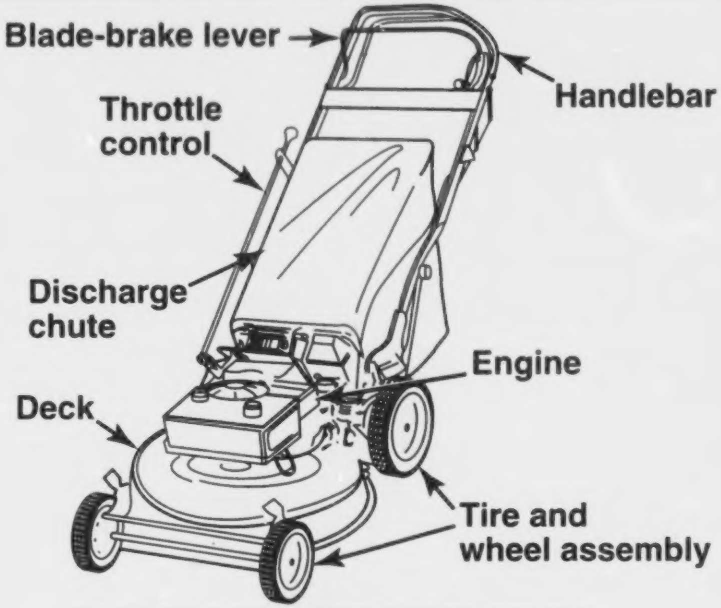
____

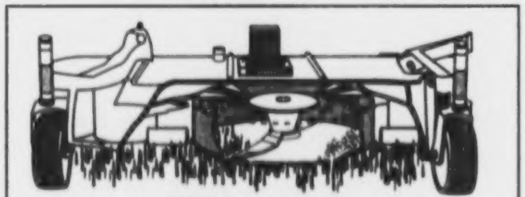
Teacher signature ______________________ Date ______________

Student signature ______________________ Date ______________

Permission to duplicate this form is granted.

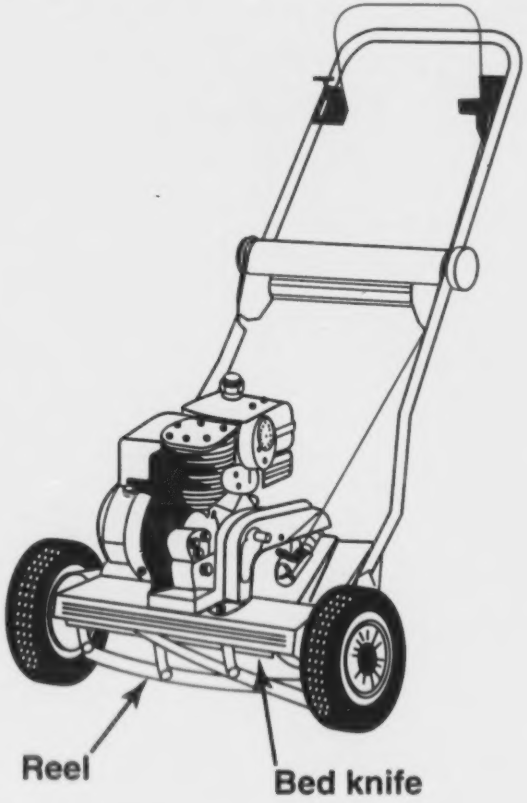
Major Components of Walk-Behind Lawn Mowers


Blade-brake lever
Handlebar
Throttle control
Discharge chute
Engine
Deck
Tire and wheel assembly



Blade motion

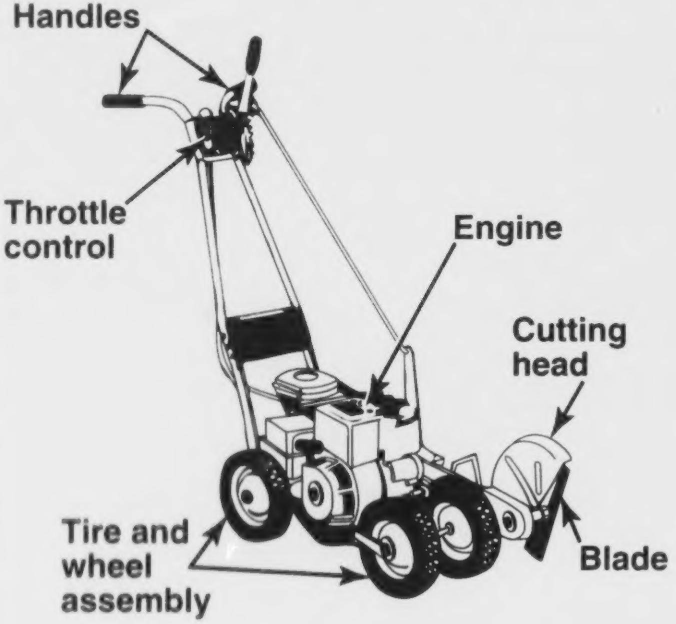
Lawn mower with rotary blades


Reel
Bed knife

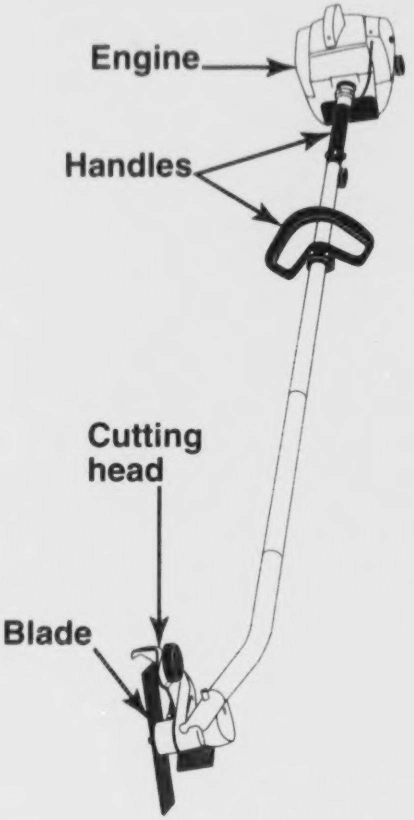
Lawn mower with reel blades

TM 1

Major Components of Edgers

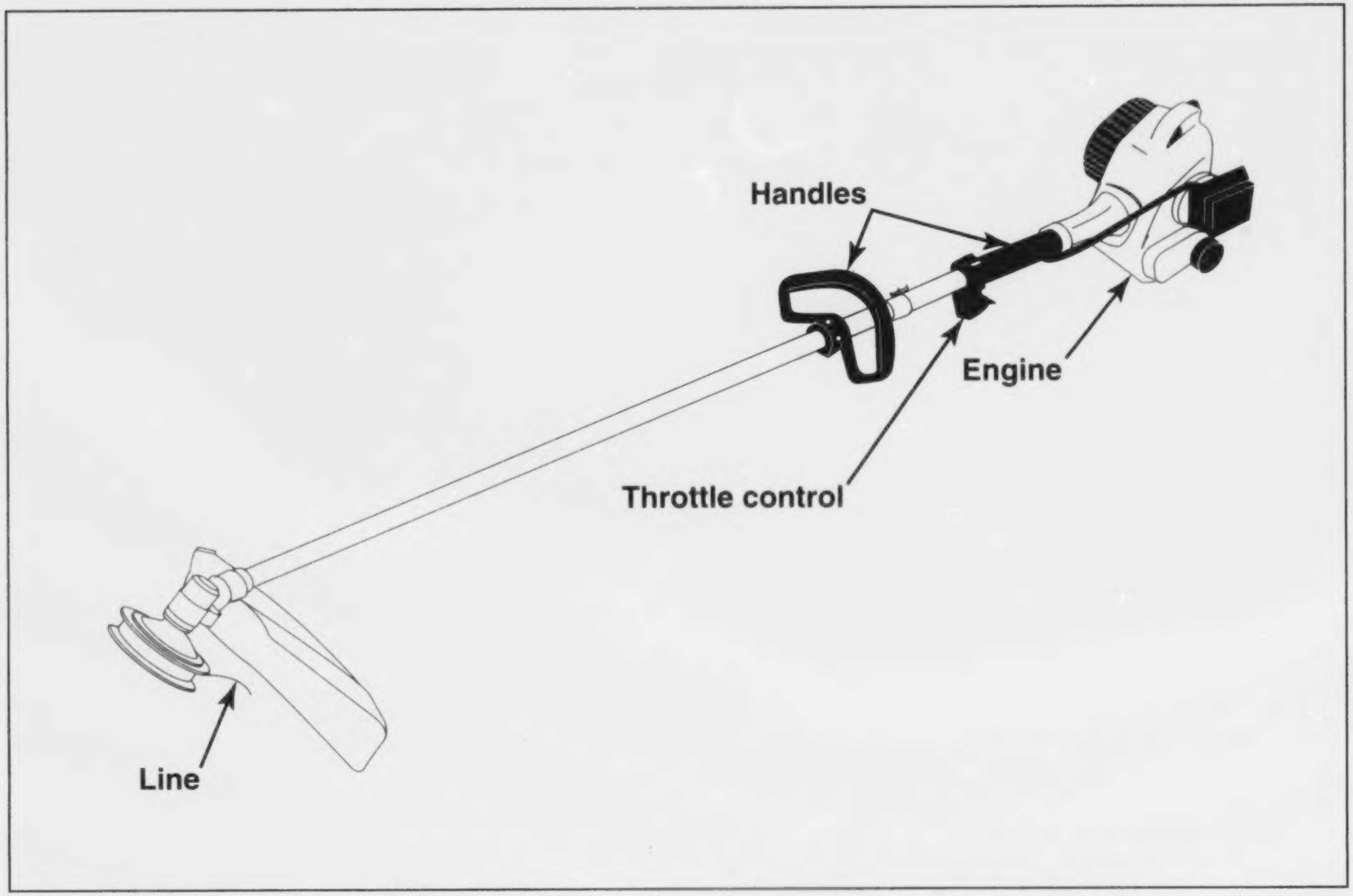

Handles
Throttle control
Engine
Cutting head
Tire and wheel assembly
Blade

Walk-behind edger


Engine
Handles
Cutting head
Blade

Carried, stick-type edger

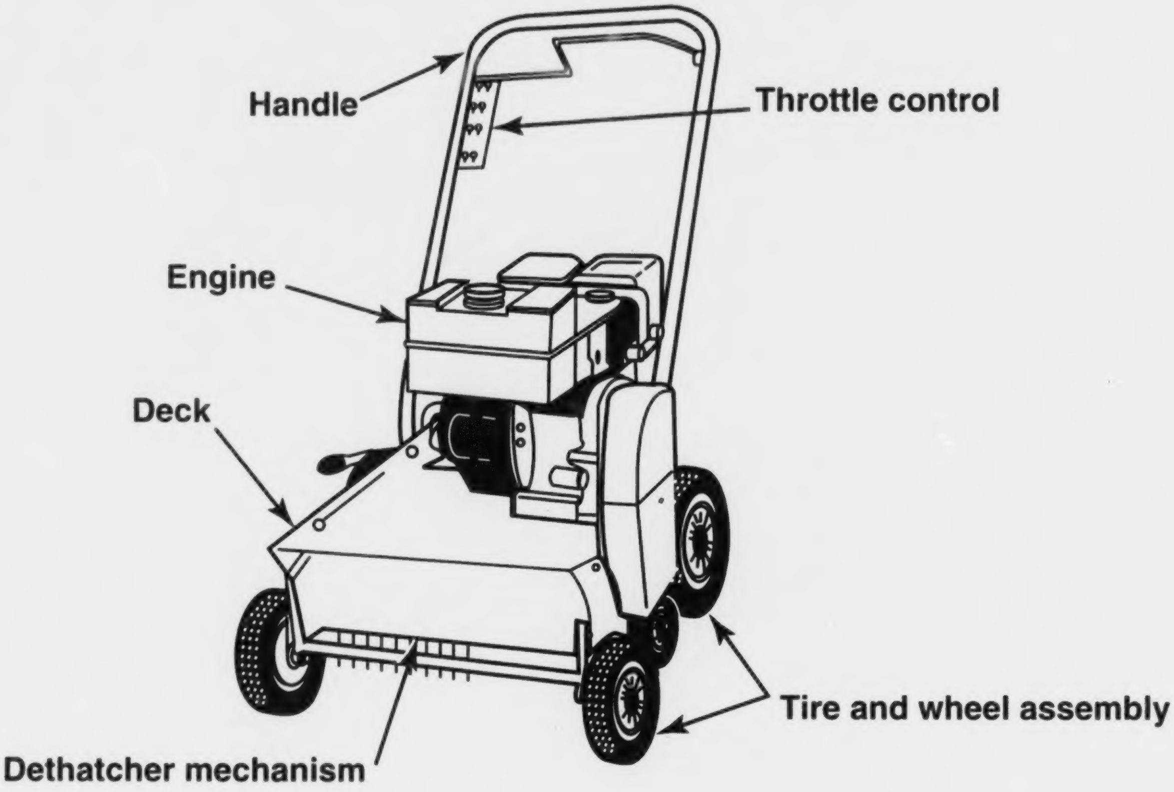
Major Components of Trimmers


Handles
Engine
Throttle control
Line

Lawn and Garden Equipment, Unit 2
Teacher Page 89

TM 3

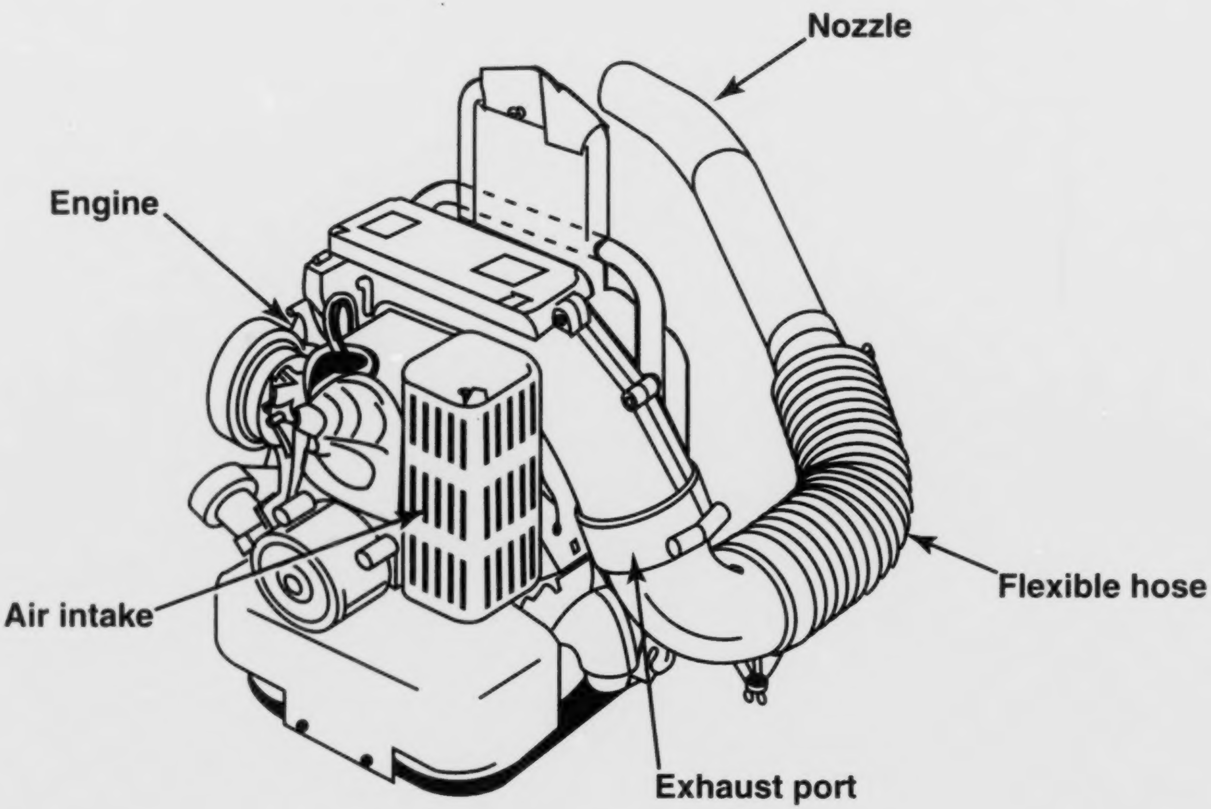
Major Components of Dethatchers


Handle
Throttle control
Engine
Deck
Tire and wheel assembly
Dethatcher mechanism

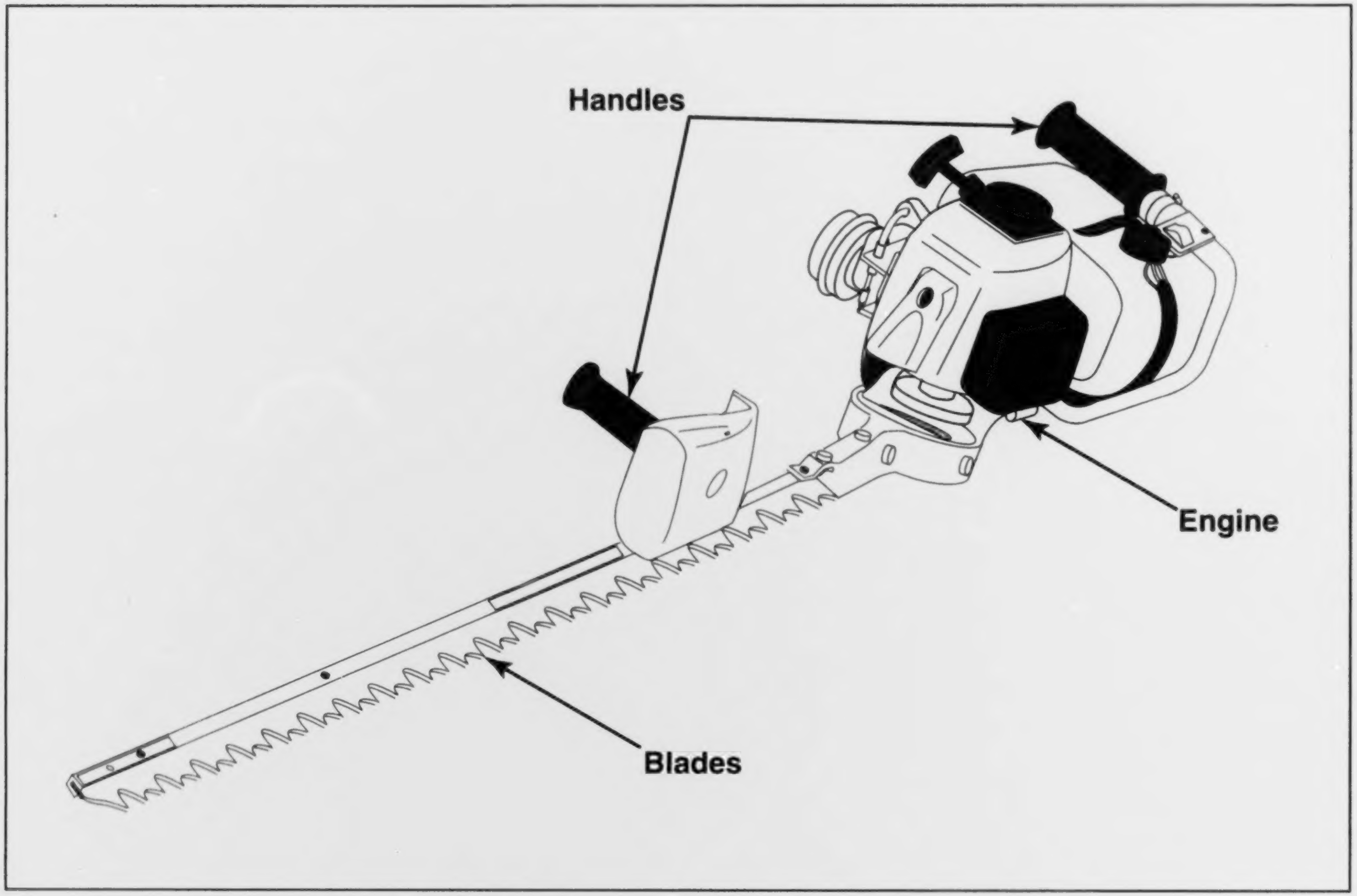
Lawn and Garden Equipment, Unit 2
Teacher Page 91

TM 4

Major Components of Blowers


Nozzle
Engine
Flexible hose
Air intake
Exhaust port

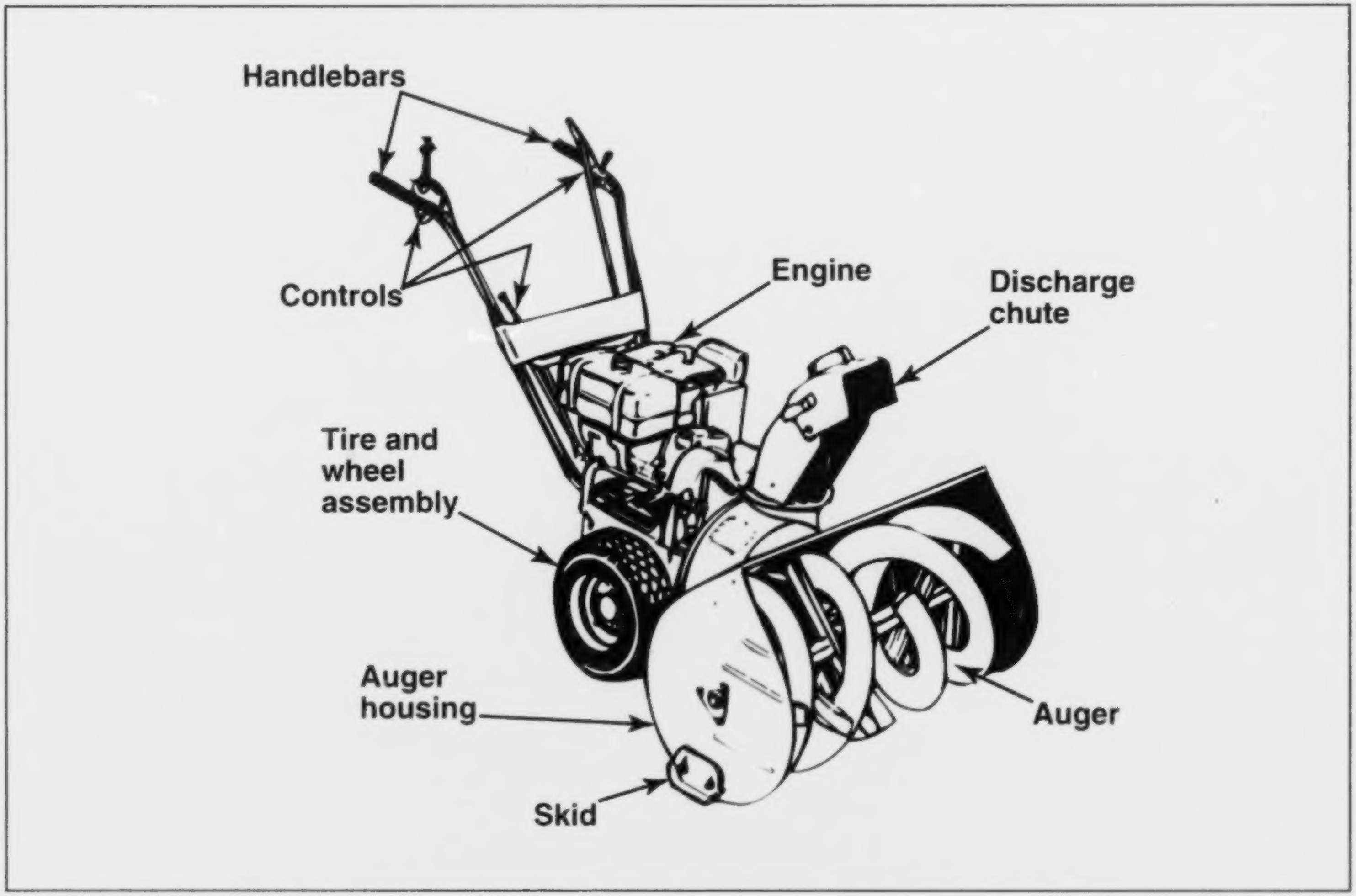
Major Components of Hedge Clippers


Handles
Engine
Blades

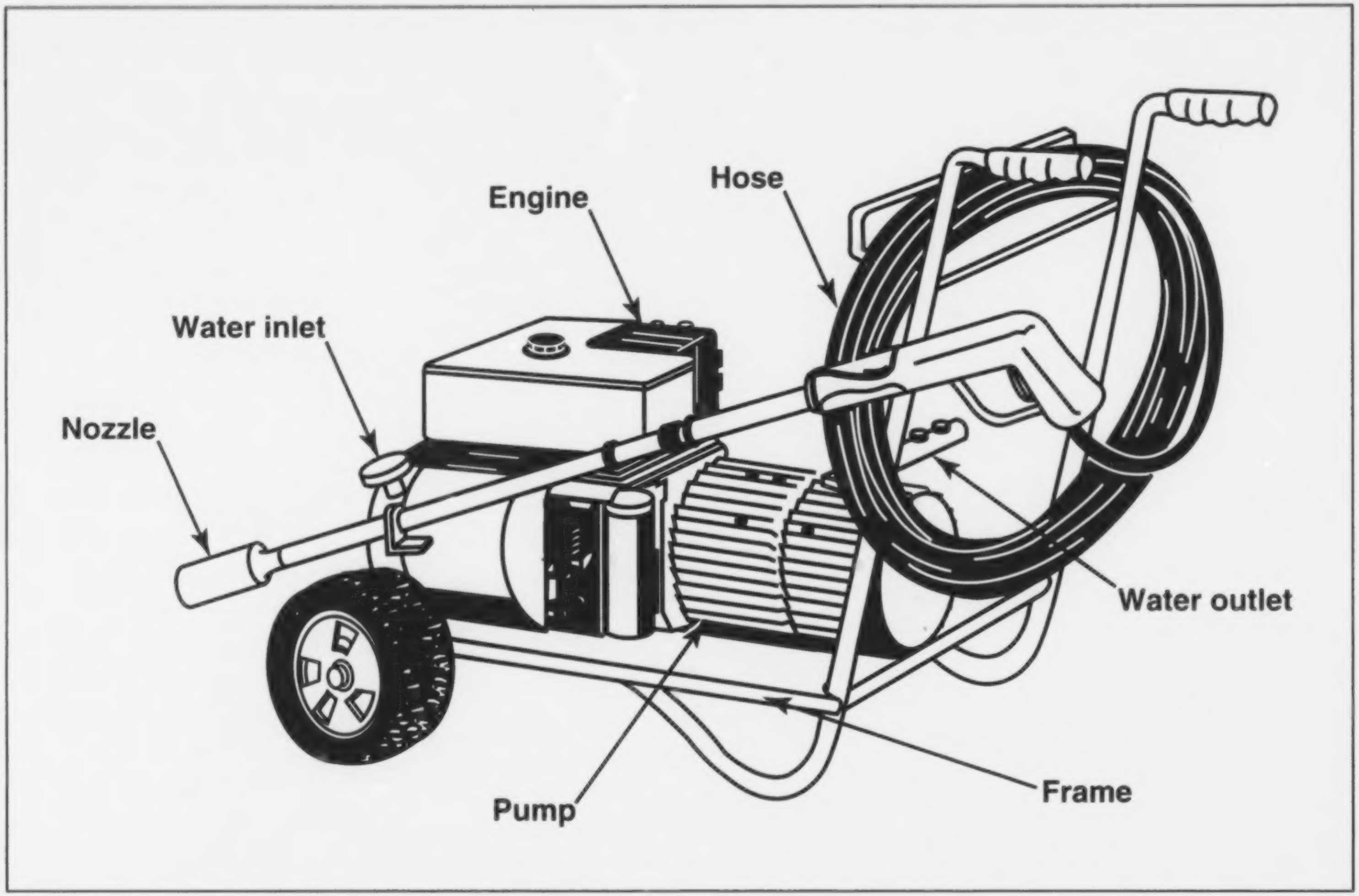
Lawn and Garden Equipment, Unit 2
Teacher Page 95

TM 6

Major Components of Snow Blowers


Handlebars
Engine
Discharge chute
Controls
Tire and wheel assembly
Auger housing
Auger
Skid

Major Components of Pressure Washers


Engine
Hose
Water inlet
Nozzle
Water outlet
Pump
Frame

Lawn and Garden Equipment, Unit 2
Teacher Page 99

TM 8

Job Sheet 1

Worksheet—Perform Routine Maintenance on Lawn Mowers

Name ______________________________ Attempt number __________

Date ______________________________

Part A: Pre-performance check

Job ______________________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________________

  Equipment model/type and code ______________________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________________

  Section/page number of procedure ______________________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________________

Job Sheet 1

Worksheet—Perform Routine Maintenance on Lawn Mowers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

____

____

Job Sheet 2

Worksheet—Repair Lawn Mowers

Name ______________________________ Attempt number ____________

Date ______________________________

Part A: Pre-performance check

Job ____

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________________

  Equipment model/type and code ______________________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________________

  Section/page number of procedure ______________________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________________

Job Sheet 2

Worksheet—Repair Lawn Mowers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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____

Job Sheet 3

Worksheet—Perform Routine Maintenance on Edgers

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 3

Worksheet—Perform Routine Maintenance on Edgers

Part B: **Performance evaluation**

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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____

Job Sheet 4

Worksheet—Repair Edgers

Name ______________________ Attempt number __________

Date ______________________

Part A: **Pre-performance check**

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 4

Worksheet—Repair Edgers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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Job Sheet 5

Worksheet—Perform Routine Maintenance on Trimmers

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 5

Worksheet—Perform Routine Maintenance on Trimmers

Part B: **Performance evaluation**

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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____

Job Sheet 6

Worksheet—Repair Trimmers

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 6

Worksheet—Repair Trimmers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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____

Job Sheet 7

Worksheet—Perform Routine Maintenance on Dethatchers

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 7

Worksheet—Perform Routine Maintenance on Dethatchers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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____

Job Sheet 8

Worksheet—Repair Dethatchers

Name ______________________ Attempt number __________

Date ______________________

Part A: **Pre-performance check**

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 8

Worksheet—Repair Dethatchers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ______________________________

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____

Job Sheet 9

Worksheet—Perform Routine Maintenance on Blowers

Name ______________________________ Attempt number __________

Date ______________________________

Part A: Pre-performance check

Job ______________________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________________

  Equipment model/type and code ______________________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________________

  Section/page number of procedure ______________________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________________

Job Sheet 9

Worksheet—Perform Routine Maintenance on Blowers

Part B: **Performance evaluation**

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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____

Job Sheet 10

Worksheet—Repair Blowers

Name ______________________________ Attempt number __________

Date ______________________________

Part A: **Pre-performance check**

Job ______________________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________________

  Equipment model/type and code ______________________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________________

  Section/page number of procedure ______________________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________________

Job Sheet 10

Worksheet—Repair Blowers

Part B: Performance evaluation

Evaluation criteria **Rating**

Correct procedures identified for assigned equipment. ______

Procedures completed correctly. ______

Proper tools used correctly. ______

Safety precautions observed. ______

Service meets specifications. ______

Clean-up and follow-up actions adequate. ______

Overall rating ______

Evaluator's comments ____

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Job Sheet 11

Worksheet—Perform Routine Maintenance on Hedge Clippers

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 11

Worksheet—Perform Routine Maintenance on Hedge Clippers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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____

Job Sheet 12

Worksheet—Repair Hedge Clippers

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 12

Worksheet—Repair Hedge Clippers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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____

Job Sheet 13

Worksheet—Perform Routine Maintenance on Snow Blowers

Name ______________________ Attempt number ________

Date ______________________

Part A: **Pre-performance check**

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Worksheet—Perform Routine Maintenance on Snow Blowers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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____

Job Sheet 14

Worksheet—Repair Snow Blowers

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 14

Worksheet—Repair Snow Blowers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	_____
Procedures completed correctly.	_____
Proper tools used correctly.	_____
Safety precautions observed.	_____
Service meets specifications.	_____
Clean-up and follow-up actions adequate.	_____
Overall rating	_____

Evaluator's comments ____

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Job Sheet 15

Worksheet—Perform Routine Maintenance on Pressure Washers

Name ______________________ Attempt number ________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 15

Worksheet—Perform Routine Maintenance on Pressure Washers

Part B: **Performance evaluation**

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

____

____

Job Sheet 16

Worksheet—Repair Pressure Washers

Name ______________________________ Attempt number __________

Date ______________________________

Part A: Pre-performance check

Job ______________________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________________

  Equipment model/type and code ______________________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________________

  Section/page number of procedure ______________________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________________

Job Sheet 16

Worksheet—Repair Pressure Washers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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Heavy-Duty Lawn and Garden Equipment
Unit 3

Suggested Activities

Instructional plan

Preparation

- Review unit and plan presentation. Study the specific objectives to determine the order in which you will present the objectives.

  Review the unit introduction and teaching suggestions included in the delivery and application section below, and plan classroom activities. Also note suggestions for media and supplemental materials.

  Plan presentation to take advantage of student learning styles and to accommodate special-needs students.
- Prepare the classroom by displaying posters, equipment, and tools related to heavy-duty lawn and garden equipment.
- Make transparencies from the transparency masters included in the teacher pages of this unit.
- Select teacher components (written test, unit evaluation form) you want to distribute to your students. Copy and prepare these components for distribution.
- Review the job sheets and worksheets in the student edition and locate the worksheet masters included in the teacher pages of this unit. Copy and prepare extra worksheets for distribution to your students.

Delivery and application

Unit introduction

The skill areas appearing in bold-face type in the unit introduction and teaching suggestions refer to the academic and workplace skills identified in *What Work Requires of Schools: A SCANS Report for America 2000* and *Workplace Basics: The Skills Employers Want*. These have been adapted by MAVCC.

- Provide students with copies of the student materials. You may choose to begin by discussing the objective sheet. Review the unit and specific objectives with the students. Discuss how meeting the unit objective will improve their employability or will increase their value as an employee. Explain how the specific objectives support the unit objective.

Teaching suggestions

Objective 1 State safety rules for servicing heavy-duty lawn and garden equipment.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

Suggested Activities

- Invite victims of heavy-duty lawn and power equipment accidents or medical personnel to discuss the dangers related to this category of equipment. Review the various pieces of equipment covered in this unit and discuss applicable safety precautions, emphasizing those presented in the information sheet. Have students review service manuals for the equipment being studied to determine safety precautions listed in them. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 2 State the functions of the major components of garden tractors.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 1 to show the major components of garden tractors. **(Reading/listening for content)**

- Provide actual examples of various sizes and designs of garden tractors with various attachments. Point out similarities and differences. Give an overview of related service procedures. Have students identify corresponding components of different types of garden tractors, such as parking-brake systems, fuel tanks, drive axles, etc. **(Listening; reasoning; seeing things in the mind's eye; system interrelationships)**

Objective 3 State the operating feature used to classify garden tractors.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Provide actual examples of front- and rear-engine, two-wheel-drive and four-wheel-drive tractor designs. Discuss advantages and disadvantages of each design for specific operations. Have the students brainstorm the impact of drive systems on other design features. Discuss the impact on service procedures. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 4 Complete statements about the principles of operation of garden tractors.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Use actual equipment to demonstrate the operation of a garden tractor and its systems. Allow students to operate garden tractors and actuate controls. Discuss how the uses and design of garden tractors justify the incorporation of certain features. For example, a unit that has an electric starter is more convenient if it also has a battery, and the battery is more useful if there is an alternator to recharge the battery, which means that it is possible to support headlights and that an ammeter might be helpful. Discuss the trade-offs of design decisions, such as added cost versus a more attractive machine, increased weight and complexity and thus more load on the engine, additional service requirements, etc. **(Listening; reasoning; seeing things in the mind's eye; system interrelationships)**

Suggested Activities

Objective 5 State the functions of the major components of riding lawn mowers.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 2 to show the major components of riding lawn mowers. **(Reading/listening for content)**

- Provide actual examples of various types of riding lawn mowers. Relate their design and operation to that of garden tractors and other equipment with which the students are familiar. **(Listening; reasoning; seeing things in the mind's eye; system interrelationships)**

Objective 6 State the operating feature used to classify riding lawn mowers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Provide actual examples of both front- and rear-engine designs. Discuss advantages and disadvantages of each design for specific operations. Have the students brainstorm the impact of engine placement on other design features. Discuss the impact of engine placement on service procedures. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 7 Complete statements about the principles operation of riding lawn mowers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate the operation of riding lawn mowers of various designs. Compare the operation to garden tractors and other equipment with which the students are familiar. Discuss safety concerns in the operation of riding lawn mowers. Allow the students to operate the equipment. Discuss service requirements based on the design and operation of the equipment. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 8 List typical service procedures required for garden tractors and riding lawn mowers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate relevant service procedures. Discuss the tools, materials, techniques, and safety precautions applicable to each procedure. Discuss differences in procedures due to design, manufacturer, application, and other factors. Emphasize procedures and techniques used in your facilities. Familiarize students with the location of reference materials, tools, equipment, and other resources required for performing these service procedures. **(Listening; reasoning; seeing things in the mind's eye; acquiring, organizing, interpreting, and processing information; system interrelationships; applying technology)**

Suggested Activities

- Use garden tractors and riding lawn mowers as examples to discuss seasonal storage and return-to-service procedures. Point out that such procedures are required for most power product equipment in those parts of the world that experience seasonal changes, especially with regard to lawn and garden and household maintenance equipment, which is likely to be used only part of the year. Have the students check service manuals for garden tractors and other pieces of equipment to determine the seasonal storage and return-to-service requirements. Have local service providers talk to the class about the importance of seasonal service and the amount of their business that directly involves seasonal service or results from improper seasonal service. Demonstrate the procedures that are unique to seasonal service and return-to-service procedures. **(Listening; reasoning; seeing things in the mind's eye; acquiring, organizing, interpreting, and processing information; system interrelationships; applying technology)**

Job Sheet 1 Perform routine maintenance on garden tractors and riding lawn mowers.

- Have students locate Job Sheet 1 and the worksheet associated with the job sheet. Demonstrate the procedures for performing routine maintenance on garden tractors and riding lawn mowers. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with garden tractors and riding lawn mowers that require routine maintenance and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 1.

Job Sheet 2 Repair garden tractors and riding lawn mowers.

- Have students locate Job Sheet 2 and the worksheet associated with the job sheet. Demonstrate the procedures for repairing garden tractors and riding lawn mowers. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with garden tractors and riding lawn mowers that require repair and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 2.

Objective 9 State the functions of the major components of tillers.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 3 to show the major components of tillers. **(Reading/listening for content)**

Suggested Activities

- Provide actual examples of various types of tillers. Relate their design and operation to that of garden tractors and other equipment with which the students are familiar, including tiller tractor attachments. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 10 State the operating feature used to classify tillers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**
- Provide actual examples of both front- and rear-tine designs. Discuss advantages and disadvantages of each design for specific operations. Have the students brainstorm the impact of tine placement on other design features, such as frame strength, engine balance, safety devices, etc. Discuss the impact of tine placement on service procedures. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 11 Complete statements about the principles of operation of tillers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**
- Demonstrate the operation of tillers of various designs. Compare the operation to garden tractors and other equipment with which the students are familiar. Discuss safety concerns in the operation of tillers and point out safeguards and shut-offs. Allow the students to operate the equipment. Discuss service requirements based on the design and operation of the equipment. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 12 List typical service procedures required for tillers.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**
- Demonstrate relevant service procedures. Discuss the tools, materials, techniques, and safety precautions applicable to each procedure. Discuss differences in procedures due to design, manufacturer, application, and other factors. Emphasize procedures and techniques used in your facilities. Familiarize students with the location of reference materials, tools, equipment, and other resources required for performing these service procedures. **(Listening; reasoning; seeing things in the mind's eye; acquiring, organizing, interpreting, and processing information; system interrelationships; applying technology)**

Suggested Activities

Job Sheet 3 Perform routine maintenance on tillers.

- Have students locate Job Sheet 3 and the worksheet associated with the job sheet. Demonstrate the procedures for performing routine maintenance on tillers. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with tillers that require routine maintenance and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 3.

Job Sheet 4 Repair tillers.

- Have students locate Job Sheet 4 and the worksheet associated with the job sheet. Demonstrate the procedures for repairing tillers. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with tillers that require repair and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 4.

Objective 13 State the functions of the major components of log splitters.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 4 to show the major components of log splitters. **(Reading/listening for content)**

- Provide actual examples of various types of log splitters. Relate their design and operation to that of garden tractors and other equipment with which the students are familiar. For example, compare and contrast the design of the hydraulic systems and the lack of drive wheels. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 14 State the operating feature used to classify log splitters.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Provide actual examples of log-splitter designs. Discuss advantages and disadvantages of each design for specific operations. Have the students brainstorm the impact of design variations on other design features. Discuss the impact of design on service procedures. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Suggested Activities

Objective 15 Complete statements about the principles of operation of log splitters.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate the operation of log splitters of various designs. Compare the operation to garden tractors and other equipment with which the students are familiar. Emphasize hydraulic operations as related to lift systems, for example. Discuss safety concerns in the operation of log splitters. Allow the students to operate the equipment. Discuss service requirements based on the design and operation of the equipment. **(Listening; seeing things in the mind's eye; interpreting and processing information; system interrelationships; applying technology)**

Objective 16 List typical service procedures required for log splitters.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate relevant service procedures. Discuss the tools, materials, techniques, and safety precautions applicable to each procedure. Discuss differences in procedures due to design, manufacturer, application, and other factors. Compare service-procedure frequency for log splitters to other types of equipment, showing that engine service, for example, may be common in both types of equipment while transmission service would be more common for riding lawn mowers and hydraulic service would be more common for log splitters. Have the students speculate on how these differences can affect a power product equipment service operation in different areas of the country or different regions of your state. **(Listening; reasoning; seeing things in the mind's eye; acquiring, organizing, interpreting, and processing information; system interrelationships)**

- Emphasize procedures and techniques used in your facilities. Familiarize students with the location of reference materials, tools, equipment, and other resources required for performing these service procedures. **(Listening; reasoning; seeing things in the mind's eye; acquiring, organizing, interpreting, and processing information; system interrelationships; applying technology)**

Job Sheet 5 Perform routine maintenance on log splitters.

- Have students locate Job Sheet 5 and the worksheet associated with the job sheet. Demonstrate the procedures for performing routine maintenance on log splitters. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with log splitters that require routine maintenance and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 5.

Suggested Activities

Job Sheet 6 Repair log splitters.

- Have students locate Job Sheet 6 and the worksheet associated with the job sheet. Demonstrate the procedures for repairing log splitters. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with log splitters that require repair and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 6.

Objective 17 State the functions of the major components of shredders.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 5 to show the components of shredders. **(Reading/listening for content)**

- Provide actual examples of various types of shredders. Relate their design and operation to that of garden tractors and other equipment with which the students are familiar, including PTO-driven shredder attachments. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 18 Match types of shredders to their correct descriptions.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Provide actual examples of shredder designs. Discuss advantages and disadvantages of each design for specific operations. Have the students brainstorm the impact of certain features on other design features, such as having only a top-loading hopper versus having both top-loading and leaf-ramp hoppers. Discuss the impact of engine size on equipment capabilities, design, and service procedures. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships)**

Objective 19 Complete statements about the principles of operation of shredders.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate the operation of shredders of various designs. Compare the operation to garden tractors and other equipment with which the students are familiar. Emphasize blade drive and material discharge, for example. Discuss safety concerns in the operation of shredders. Allow the students to operate the equipment. Discuss service requirements based on the design and operation of the equipment. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information; system interrelationships; applying technology)**

Suggested Activities

Objective 20 List typical service procedures required for shredders.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate relevant service procedures. Discuss the tools, materials, techniques, and safety precautions applicable to each procedure. Discuss differences in procedures due to design, manufacturer, application, and other factors. Emphasize procedures and techniques used in your facilities. Familiarize students with the location of reference materials, tools, equipment, and other resources required for performing these service procedures. **(Listening; reasoning; seeing things in the mind's eye; acquiring, organizing, interpreting, and processing information; system interrelationships; applying technology)**

Job Sheet 7 Perform routine maintenance on shredders.

- Have students locate Job Sheet 7 and the worksheet associated with the job sheet. Demonstrate the procedures for performing routine maintenance on shredders. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with shredders that require routine maintenance and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 7.

Job Sheet 8 Repair shredders.

- Have students locate Job Sheet 8 and the worksheet associated with the job sheet. Demonstrate the procedures for repairing shredders. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with shredders that require repair and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 8.

Evaluation

- Evaluate the job sheets.

  When the student is ready to perform a specific task, obtain a copy of the worksheet associated with each job sheet. Worksheets may be found in the student edition and in the teacher pages following the transparency masters. Then, observe the student performing the procedure.

  After the student has completed the procedure, rate the student using the criteria provided on the worksheet. If the student's performance is unacceptable, have the student review the materials and perform the procedure again for evaluation.

Suggested Activities

Two sample performance evaluation keys are provided below. Many other keys are available. Select one evaluation key (grading scale) that best fits your program needs.

Performance Evaluation Keys

Sample A

4 — Skilled—Can perform job with no additional training.
3 — Moderately skilled—Has performed job during training program; limited additional training may be required.
2 — Limited skill—Has performed job during training program; additional training is required to develop skill.
1 — Unskilled—Is familiar with process, but is unable to perform job.

Sample B

Yes—Can perform job with no additional training.

No—Is unable to perform job satisfactorily.

- Give the written test. See the teacher page "Written Test."
- Evaluate the written test. See the teacher page "Answers to Written Test."
- Compile written-test and job-sheet scores. See the teacher page "Unit Evaluation Form."
- Reteach and retest as required.

Suggested resources

Resources used in developing this unit

Print media

- Graf, Rudolf F., and George J. Whalen. *VNR Illustrated Guide to Power Tools.* New York: Van Nostrand Reinhold Company, 1978.
- *Outdoor Power Equipment Repair.* Stillwater, Oklahoma: Mid-America Vocational Curriculum Consortium, 1985.
- *Power Tools and Equipment.* Alexandria, Virginia: Time-Life Books, Inc., 1989.
- *Riding Lawn Mower Service Manual,* 3rd ed. Overland Park, Kansas: Intertec Publishing Corporation, 1989.

Suggested Activities

Supplemental resources

Print media

- *Power Equipment Trade* magazine. Hatton-Brown Publishers, Inc., P.O. Box 2268, Montgomery, Alabama 36102.
- *Technical Handbook*. Describes the makes and types of equipment produced by MTD—one of the nation's largest manufacturers. The book covers service for most equipment systems and various types of equipment. Both light- and heavy-duty equipment types are included. Available from MTD Products, Inc. Call 1-800-422-3381.
- Service manuals for systems covered in this unit.
- Parts catalogs for systems covered in this unit. Available from equipment manufacturers.

Non-print media

- *The Physical World of a Machine*. Tel-A-Train, 309 North Market Street, P.O. Box 4752, Chattanooga, Tennessee 37405, (615) 624-2628.
- *Roller Chain*. Tel-A-Train, 309 North Market Street, P.O. Box 4752, Chattanooga, Tennessee 37405, (615) 624-2628.
- *Special Five Tapes in One*. Section 3 of this program provides information on setting the neutral and troubleshooting the IHT hydrostatic transaxle. Available from MTD Products, Inc. Call 1-800-422-3381.
- *Special Five Tapes in One*. Section 4 of this program provides information on the disassembly of tiller chain cases. The final section addresses troubleshooting and servicing of log splitters. Available from MTD Products, Inc. Call 1-800-422-3381.
- *Two Speed Transmission Disassembly and Repair*. This program is available in pre- and post-1998 editions. The videotapes cover the action of the transmission as well as the disassembly and assembly of this popular transmission. Available from MTD Products, Inc. Call 1-800-422-3381.
- *V-Belt: Proper Care*. Marshall Maintenance Productions, 529 S. Clinton Avenue, Trenton, New Jersey 08611, (800) 257-0430.
- *V-Belts*. Tel-A-Train, 309 North Market Street, P.O. Box 4752, Chattanooga, Tennessee 37405, (615) 624-2628.
- *Z Series Transmission, Repair and Neutral Adjustment Instructions.* Addresses this model of transmission used in Cub Cadet and White models of riding lawn mowers and garden tractors. Covers step-by-step transmission removal and replacement. Available from MTD Products, Inc. Call 1-800-422-3381.

Heavy-Duty Lawn and Garden Equipment
Unit 3

Answers to Written Test

1. a. Remove the spark plug whenever performing service that does not require the engine to be running, including removing material from blades, adjusting belts, etc.
   b. Do not expose the fuel to heat, flames, or sparks.
   c. Be careful when working around moving belts, chains, shafts, gears, and other parts.
   d. Be careful when handling and working near sharp surfaces such as blades and shears.
   e. Do not operate equipment with the guards and shields removed.
   f. Do not start equipment under an excessive load, such as a mower with its blade in a bind.
   g. When operating equipment that discharges debris, do not direct the discharge toward people in the area.
   h. Use proper lifting procedures, and do not try to lift or carry excessive loads.
   i. When driving operator-ridden equipment, do not exceed the incline limits of the equipment or change the center of gravity by making the equipment top heavy.

2. a. Supports the operator
   b. Allows the operator to start or shut off the engine
   c. Provides the operator with a means of guiding the direction of equipment travel
   d. Covers and protects the engine compartment
   e. Provide the illumination so the equipment can be operated in low-light conditions
   f. Protects the front of the engine compartment and provides ventilation
   g. Provides steering control and supports the front tire and wheel assemblies
   h. Supports the engine and other system components
   i. Provides the power to the drive train and the equipment drives
   j. Provides the power to start the engine
   k. Engages the brake and disengages the transmission clutch when applied
   l. Houses the mower blades and the equipment-drive connection
   m. Regulates the power from the engine that is delivered to the drive wheels
   n. Serves as the final drive and supports the rear tire and wheel assemblies
   o. Allows the operator to select transaxle-speed or transmission-speed setting
   p. Allows the operator to raise or lower the mower deck or attachments

3. Rear-wheel drive, full-time four-wheel drive, or part-time four-wheel drive

4. a. key switch; push button; flywheel
   b. drive train; drive wheels
   c. transmission; transaxle
   d. steering
   e. brake
   f. charging
   g. equipment drives
   h. Actuators

Answers to Written Test

5. a. Supports the operator
   b. Provides the operator with a means of guiding the direction of equipment travel
   c. Provides the steering control and supports the front tire and wheel assemblies
   d. Supports the engine and the other system components
   e. Provides the power to the drive train and the mower drive
   f. Engages the brake and disengages the transmission clutch when applied
   g. Houses the mower blades and the equipment-drive connection
   h. Serves as the final drive and supports the rear tire and wheel assemblies
   i. Allows the operator to select the transaxle-speed or transmission-speed setting
   j. Allows the operator to raise or lower the mower deck

6. Front engine or rear engine

7. a. manual; electric
   b. drive train; drive wheels
   c. transmission; transaxle
   d. steering
   e. brake
   f. mower
   g. Actuators

8. Answer should include any seven of the following.

- Service engine
- Service transmission/transaxle
- Service steering system, including wheel alignment
- Service starting system
- Service charging system
- Service brake system
- Service tire
- Service electrical system
- Service chassis
- Service equipment drive
- Service blade

9. a. Allow the operator to guide the tiller
   b. Allows the operator to adjust the engine speed
   c. Break up the soil
   d. Allows the operator to engage or disengage the tines
   e. Provides the power to the equipment drive
   f. Transmits the power from the engine to the tine drive axle
   g. Support the equipment and allow it to be moved with less effort

10. Front tine or rear tine

Answers to Written Test

11.
    a. belt; chain; shaft; gear
    b. engages; disengages
    c. handlebars
    d. throttle control
    e. guide bar

12. Answer should include any three of the following.

- Service engine
- Service equipment drive
- Inspect and replace tines
- Service chassis and frame

13.
    a. Supports the engine and the equipment drive
    b. Separates the fibers of the log
    c. Guides the travel of the log or wedge
    d. Provides the power to build the hydraulic pressure
    e. Provides the hydraulic power to drive the wedge or log
    f. Support the equipment and make it easier to move

14. Movable wedge/ram pushes the wedge into the log or fixed wedge/ram pushes the log into the wedge

15.
    a. hydraulic
    b. neutral
    c. unloading pressure
    d. forward
    e. wedge; wedge
    f. ram
    g. reverse

16. Answer should include any four of the following.

- Service engine
- Service hydraulic system
- Adjust or replace splitting wedge
- Service starting system
- Service tire and wheel assembly
- Service frame

17.
    a. Provides the power to drive the cutting blades
    b. Allows the operator to feed limbs, leaves, and other material into the shredder from above
    c. Allows the operator to guide the shredder to relocate the equipment
    d. Rotate to cut the material and to drive it through the shear blades
    e. Provide further cutting and reduction of the shredded material as the cutting blades push the material through them
    f. Allows the shredded material to exit the equipment

Answers to Written Test

18. a. 2
    b. 3
    c. 1

19. a. cutting
    b. intake chute; hopper
    c. cutting; shear
    d. cutting section; discharge chute

20. Answer should include any three of the following.

- Service engine
- Sharpen blade
- Service equipment drive
- Service chassis

Heavy-Duty Lawn and Garden Equipment
Unit 3

Written Test

Name ______________________________ Score ______________

1. State safety rules for servicing heavy-duty lawn and garden equipment. Write the complete safety rule on the blanks provided beside each of the terms below.

   a. Spark plug ______________________________

   b. Heat, flames, or sparks ______________________________

   c. Working around moving parts ______________________________

   d. Working near sharp surfaces ______________________________

   e. Operating equipment with guards and shields ______________________________

   f. Starting equipment under load ______________________________

   g. Operating equipment that discharges debris ______________________________

   h. Carrying loads ______________________________

   i. Driving operator-ridden equipment ______________________________

2. State the functions of the major components of garden tractors. Write your answers on the blanks provided beside each of the terms below.

   a. Seat ______________________________

   b. Ignition switch ______________________________

Written Test

c. Steering wheel

d. Shroud

e. Headlights

f. Cap

g. Front axle

h. Frame

i. Engine

j. Battery

k. Brake/clutch pedal

l. Mower deck

m. Transaxle

n. Rear axle

o. Shift lever

p. Mower-deck lift lever

Written Test

3. State the operating feature used to classify garden tractors. Write your answer on the blanks provided beside the term below.

   Drive-train arrangement ______________________________

   ____

4. Complete statements about the principles of operation of garden tractors. Write the missing word(s) on the blanks provided in the following statements.

   a. A ______________ or ______________ is used to make contact with an electric starter; the starter engages the engine ______________ to start the engine.

   b. Power from the engine is transferred to the ______________ and applied to the ______________ for movement.

   c. The ______________ or ______________ allows control of forward and reverse directions and speeds.

   d. A ______________ system provides control over side-to-side turning.

   e. A ______________ system provides the force to slow or stop the tractor.

   f. The tractor generally includes a ______________ system to restore the battery, either as an alternator or as an externally powered charger.

   g. Power from the engine is also made available to ______________, such as mowers and PTOs.

   h. ______________ are often provided for control of the attachments, such as raising or lowering the mower deck, operating lift equipment, engaging or disengaging the PTO, etc.

5. State the functions of the major components of riding lawn mowers. Write your answers on the blanks provided beside each of the terms below.

   a. Seat ______________________________

   ____

   b. Steering wheel ______________________________

   ____

   c. Front axle ______________________________

   ____

d. Frame ______________________________

____

e. Engine ______________________________

____

f. Brake/clutch pedal ______________________________

____

g. Mower deck ______________________________

____

h. Rear axle ______________________________

____

i. Shift lever ______________________________

____

j. Mower-deck lift lever ______________________________

____

6. State the operating feature used to classify riding lawn mowers. Write your answer on the blanks provided beside the term below.

Engine placement ______________________________

____

7. Complete statements about the principles of operation of riding lawn mowers. Write the missing word(s) on the blanks provided in the following statements.

a. The mower may be equipped with a ______________ starter, an ______________ starter, or both types of starters.

b. Power from the engine is transferred to the ______________ and applied to the ______________ for movement.

c. The ______________ or ______________ allows control of power to the drive wheels and may offer both forward and reverse and multiple speeds for forward.

d. A ______________ system provides control over side-to-side turning.

e. A ______________ system provides force to slow or stop the riding lawn mower.

f. Power from the engine is transferred to the ________________.

g. ________________ may be provided to engage or disengage the mower blade and for raising or lowering the mower deck.

8. List seven of the typical service procedures required for garden tractors and riding lawn mowers. Write your answers on the blanks provided below.

a. ________________________________

b. ________________________________

c. ________________________________

d. ________________________________

e. ________________________________

f. ________________________________

g. ________________________________

9. State the functions of the major components of tillers. Write your answers on the blanks provided beside each of the terms below.

a. Handlebars ________________________________

____

b. Throttle control ________________________________

____

c. Tines ________________________________

____

d. Equipment-drive clutch lever ________________________________

____

e. Engine ________________________________

____

f. Equipment drive ________________________________

____

g. Tire and wheel assemblies ________________________________

____

Written Test

10. State the operating feature used to classify tillers. Write your answer on the blanks provided beside the term below.

    Tine placement ______________________________

    ____

11. Complete statements about the principles of operation of tillers. Write the missing word(s) on the blanks provided in the following statements.

    a. The engine outputs power to the equipment drive; a __________, __________, __________, or __________ transmits power to the tine axle.

    b. The operator squeezes a lever that increases the tension on the equipment-drive belt; the action of the tensioner clutch __________ or __________ the equipment-drive belt.

    c. The operator uses the __________ to guide the tiller.

    d. A __________ regulates engine speed and, in turn, tine-rotation speed.

    e. A __________ is generally provided to control the tilling depth.

12. List three of the typical service procedures required for tillers. Write your answers on the blanks provided below.

    a. ______________________________

    b. ______________________________

    c. ______________________________

13. State the functions of the major components of log splitters. Write your answers on the blanks provided beside each of the terms below.

    a. Frame ______________________________

    ____

    b. Wedge ______________________________

    ____

    c. Track ______________________________

    ____

    d. Engine ______________________________

    ____

e. Hydraulic system ______________________________

____

f. Tire and wheel assemblies ______________________________

____

14. State the operating feature used to classify log splitters. Write your answer on the blanks provided beside the term below.

Wedge/ram configuration ______________________________

____

15. Complete statements about the principles of operation of log splitters. Write the missing word(s) on the blanks provided in the following statements.

a. The engine provides the power to drive the ________________ system.

b. When the actuating lever is in the ________________ position, the pump of the hydraulic system moves fluid through the system so that fluid flows from the reservoir, through the pump, through the directional valve, and back to the reservoir.

c. Fluid pressure builds until it reaches a preset level called the ________________, at which point all or part of the fluid is diverted back to the reservoir.

d. When the actuator is in the ________________ position, fluid pressure is applied to the back side of the ram piston, causing it to move forward with a great deal of force.

e. The movement of the piston pushes the ________________ down the rail and into the log or pushes the log into the ________________.

f. When the ________________ is fully extended, a relief valve opens so that pump pressure is diverted to the reservoir.

g. When the actuating lever is in the ________________ position, pressure is applied to the other side of the piston to move it back in the cylinder.

16. List four of the typical service procedures required for log splitters. Write your answers on the blanks provided below.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

17. State the functions of the major components of shredders. Write your answers on the blanks provided beside each of the terms below.

   a. Engine ____

   ____

   b. Hopper ____

   ____

   c. Handlebar ____

   ____

   d. Cutting blades ____

   ____

   e. Shear plates ____

   ____

   f. Discharge chute ____

   ____

18. Match types of shredders to their correct descriptions. Write the numbers on the blanks provided.

_______ a. Uses an engine generally of less than 4 horsepower to grind leaves, grass cuttings, and similar light materials, and usually discharges the mulch onto the ground		1. Chipper
_______ b. Uses an engine in the 4- to 8-horsepower range to grind leaves, branches, and other materials, and usually accommodates a bag into which the mulch is discharged		2. Compost grinder
_______ c. Uses an engine generally of 8 or more horsepower to grind leaves, branches, and small limbs, and usually discharges the mulch onto the ground or into a wagon		3. Shredder/ bagger

19. Complete statements about the principles of operation of shredders. Write the missing word(s) on the blanks provided in the following statements.

    a. The engine powers two or more rotary __________________ blades.

    b. Debris is deposited into an __________________ or __________________.

    c. The rotation of the __________________ blades forces the debris between __________________ plates; this action cuts the debris into fine particles.

    d. The rotation of the blades also creates a draft that pulls the debris into the __________________ and forces it out the __________________.

20. List three of the typical service procedures required for shredders. Write your answers on the blanks provided below.

    a. ____

    b. ____

    c. ____

Permission to duplicate this test is granted.

Heavy-Duty Lawn and Garden Equipment
Unit 3

Unit Evaluation Form

Student name ______________________ Unit rating ____________

Job-sheet ratings

Job Sheet 1—Perform Routine Maintenance on Garden Tractors and Riding Lawn Mowers Rating ______

Comments: ______________________

Job Sheet 2—Repair Garden Tractors and Riding Lawn Mowers Rating ______

Comments: ______________________

Job Sheet 3—Perform Routine Maintenance on Tillers Rating ______

Comments: ______________________

Job Sheet 4—Repair Tillers Rating ______

Comments: ______________________

Job Sheet 5—Perform Routine Maintenance on Log Splitters Rating ______

Comments: ______________________

Job Sheet 6—Repair Log Splitters Rating ______

Comments: ______________________

Job Sheet 7—Perform Routine Maintenance on Shredders Rating ______

Comments: ______________________

Unit Evaluation Form

Job Sheet 8—Repair Shredders Rating ________

Comments: ____

____

Written-test scores

Pretest __________ Posttest __________ Other __________

Comments: ____

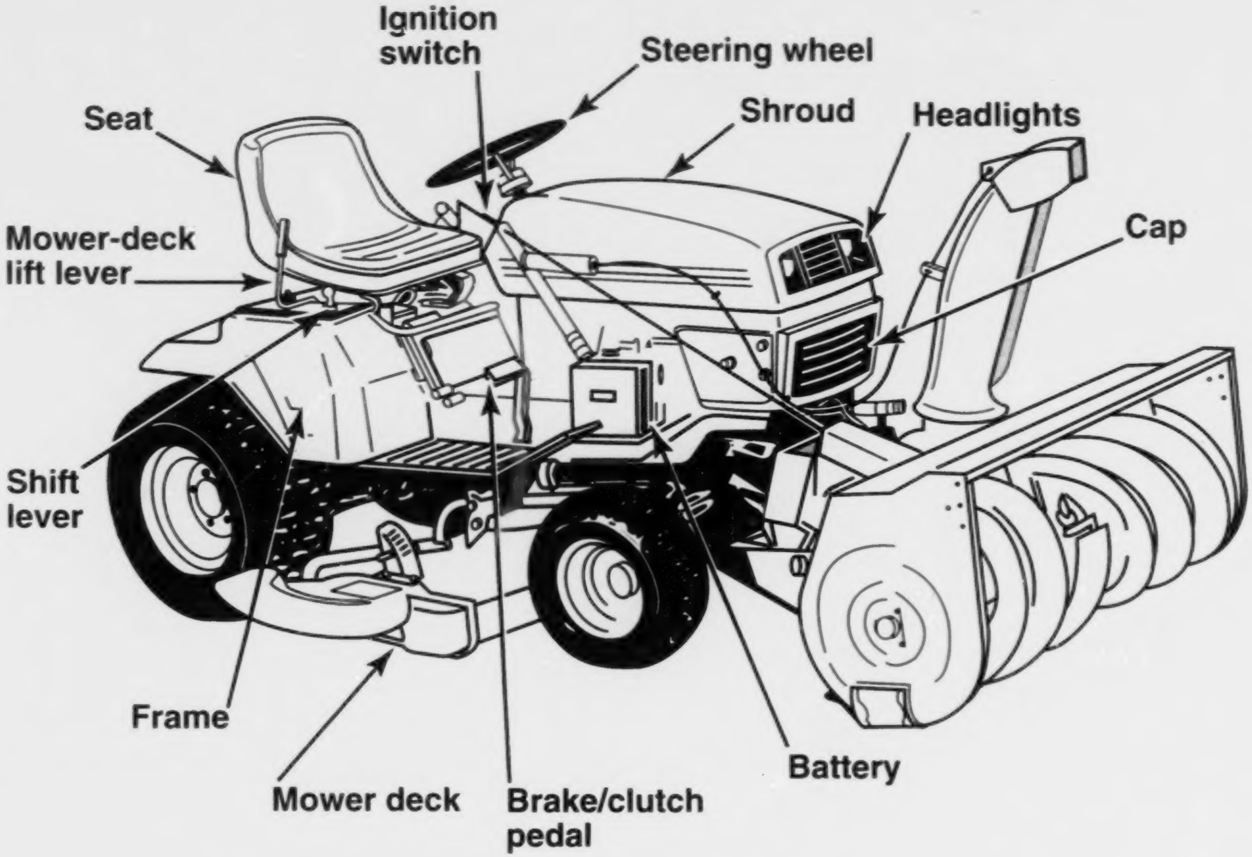
____

Teacher signature ______________________ Date __________

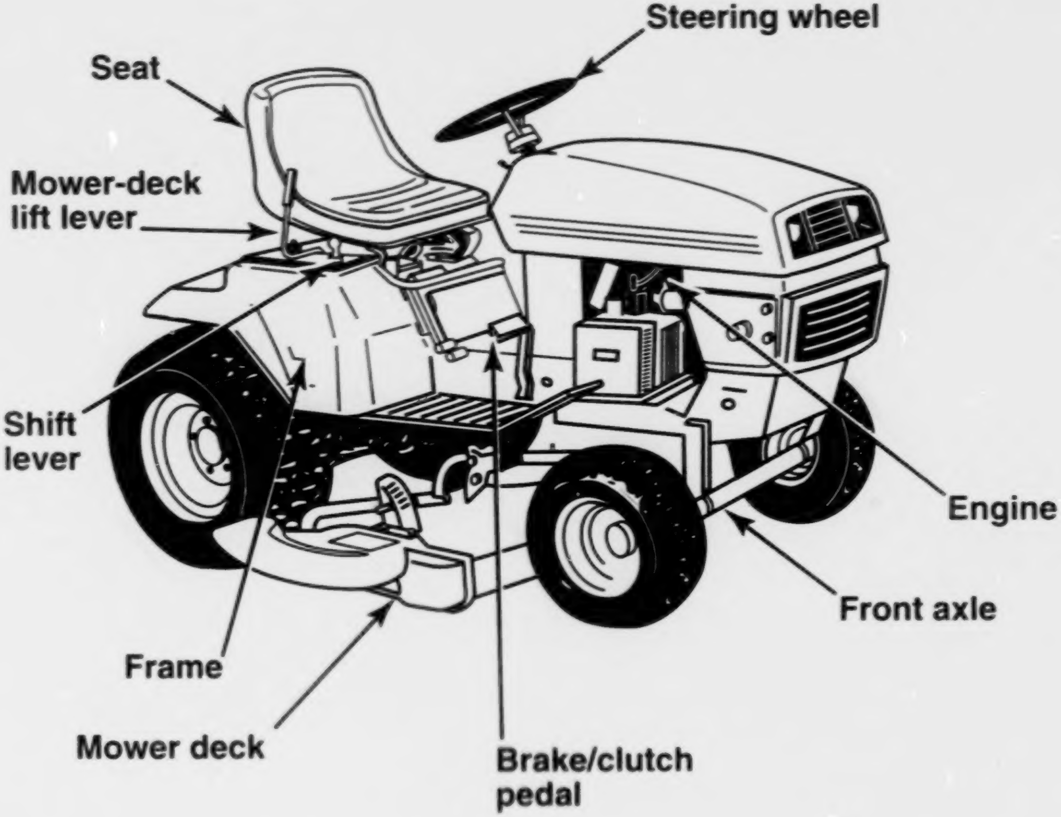
Student signature ______________________ Date __________

Permission to duplicate this form is granted.

Major Components of Garden Tractors


Ignition switch
Steering wheel
Seat
Shroud
Headlights
Mower-deck lift lever
Cap
Shift lever
Frame
Mower deck
Brake/clutch pedal
Battery

Major Components of Riding Lawn Mowers


Steering wheel
Seat
Mower-deck lift lever
Shift lever
Engine
Front axle
Frame
Mower deck
Brake/clutch pedal

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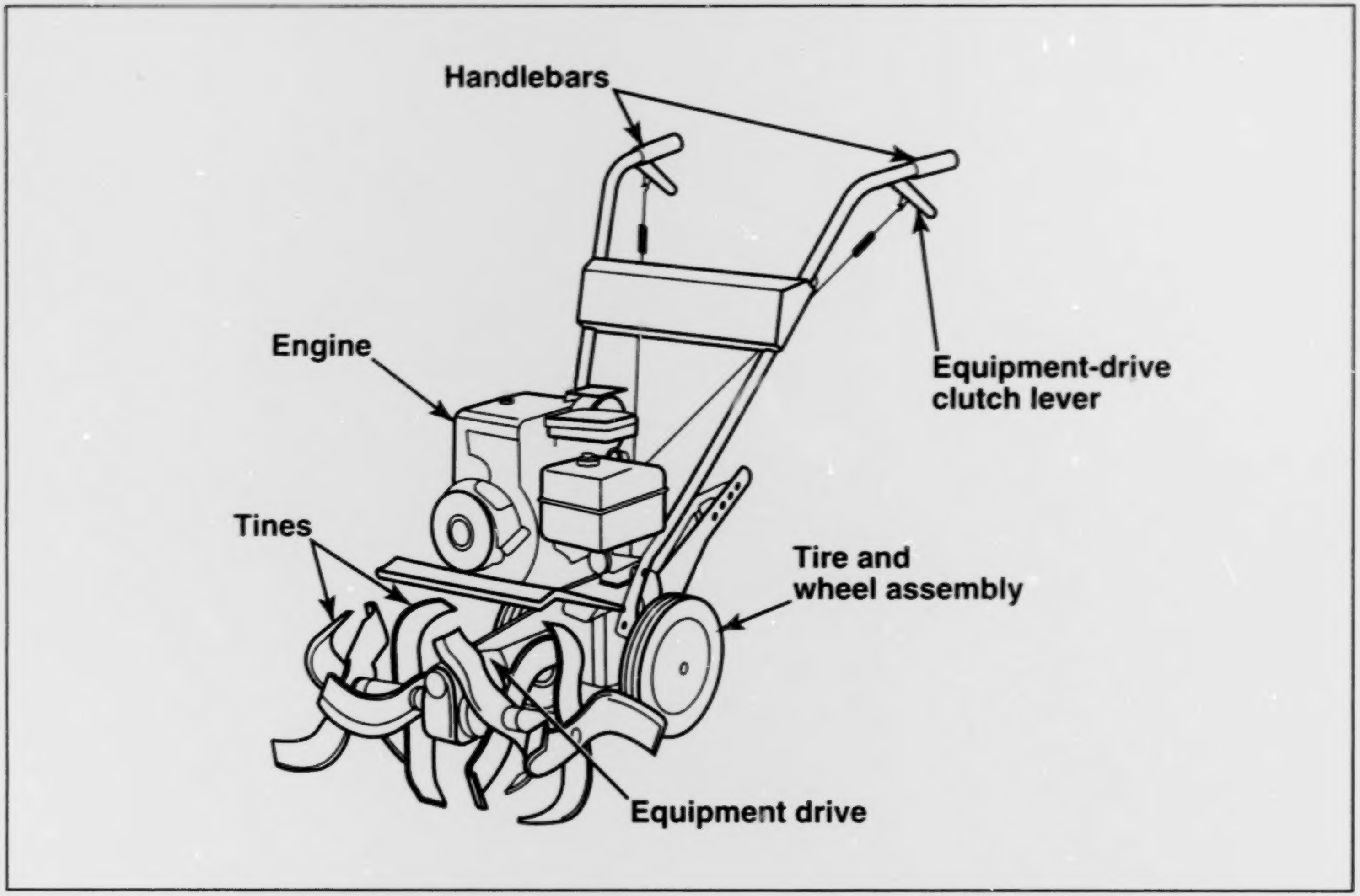
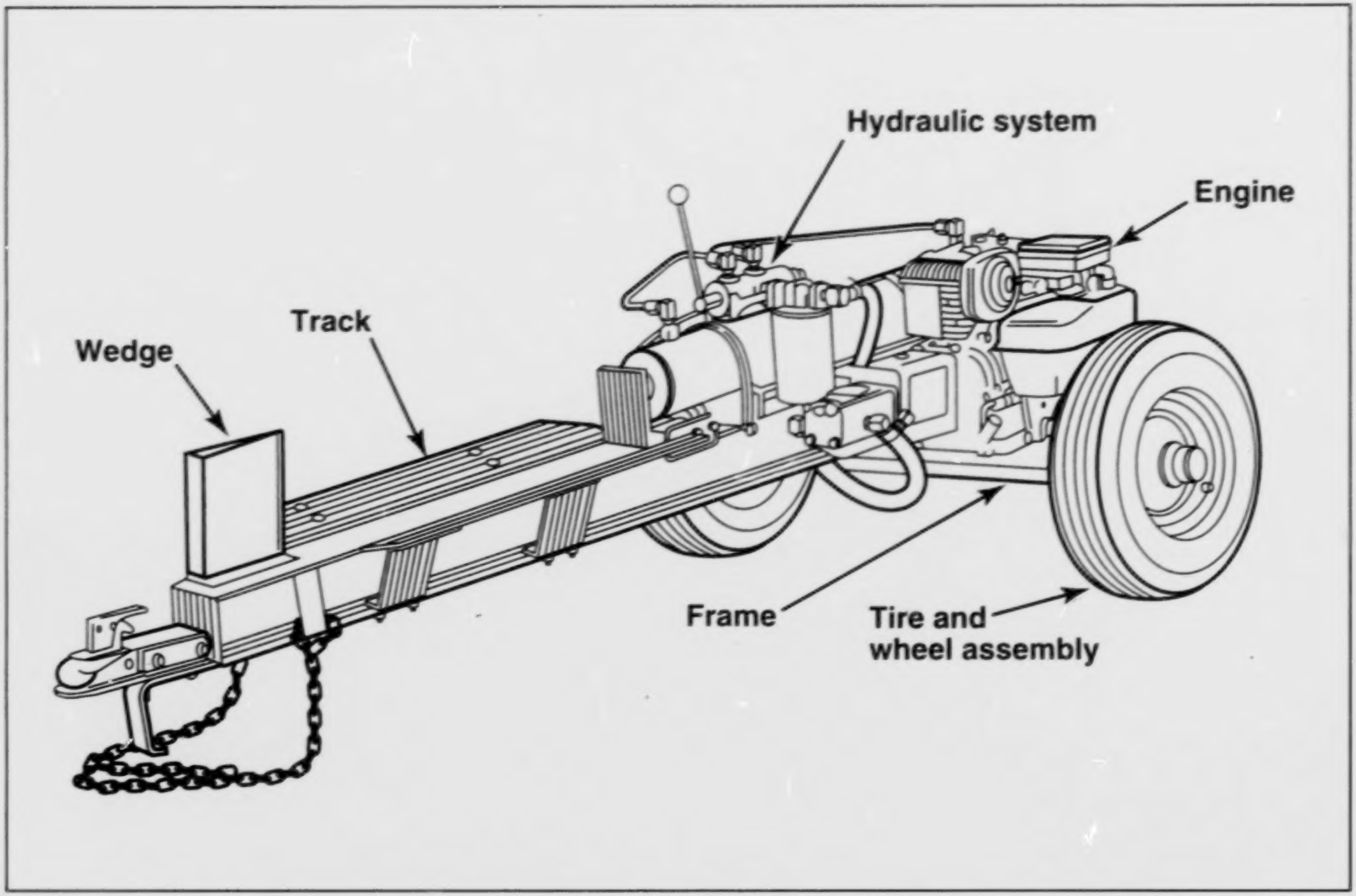
Teacher Page 163

TM 2

Major Components of Tillers


Handlebars
Engine
Equipment-drive clutch lever
Tines
Tire and wheel assembly
Equipment drive

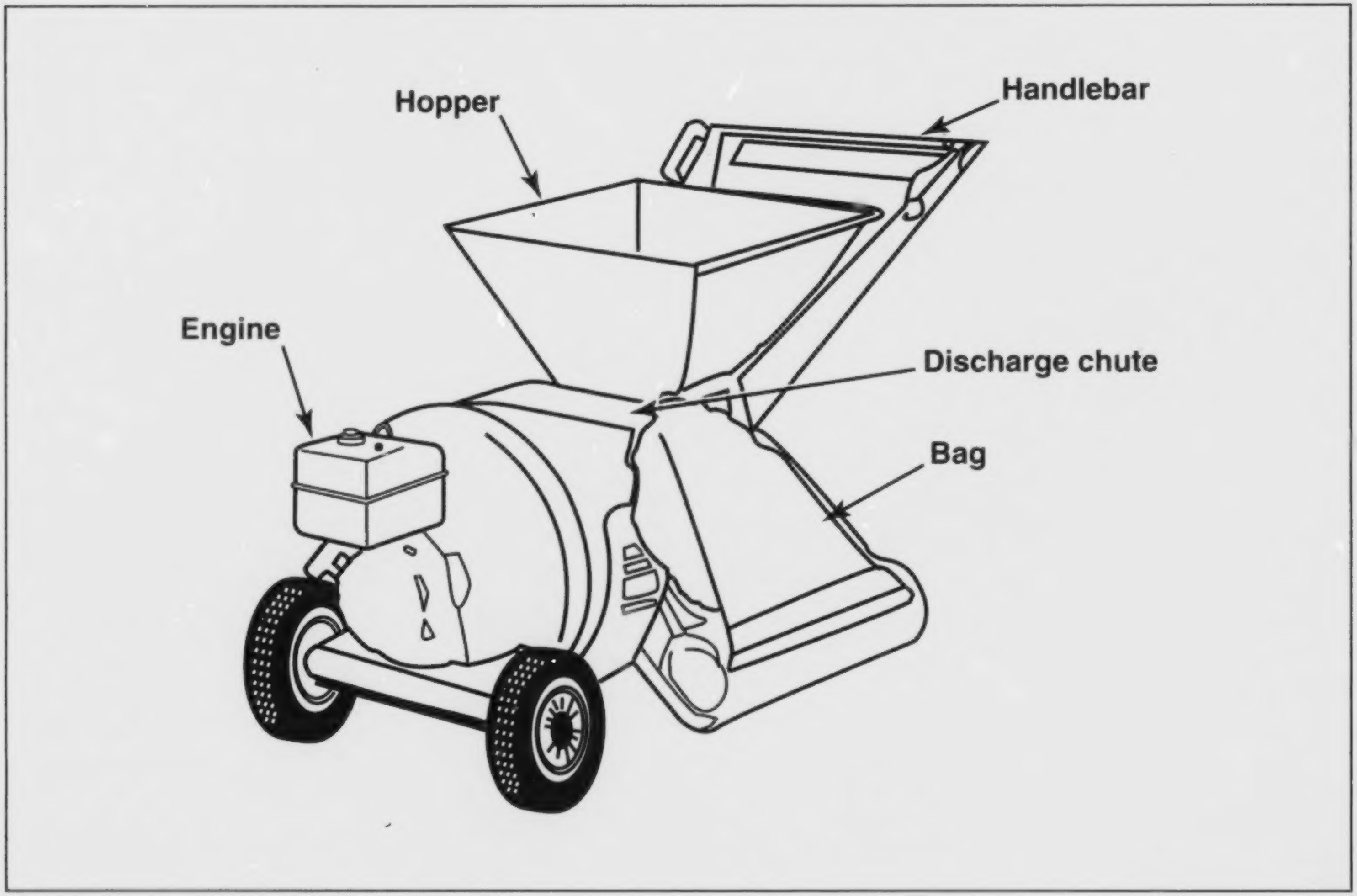
Major Components of Log Splitters


Hydraulic system
Engine
Track
Wedge
Frame
Tire and wheel assembly

Lawn and Garden Equipment, Unit 3
Teacher Page 167

TM 4

Major Components of Shredders


Hopper
Handlebar
Engine
Discharge chute
Bag

Job Sheet 1

Worksheet—Perform Routine Maintenance on Garden Tractors and Riding Lawn Mowers

Name ______________________ Attempt number ________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 1

Worksheet—Perform Routine Maintenance on Garden Tractors and Riding Lawn Mowers

---

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ______________________________

____

____

Job Sheet 2

Worksheet—Repair Garden Tractors and Riding Lawn Mowers

Name ______________________ Attempt number ________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 2

Worksheet—Repair Garden Tractors and Riding Lawn Mowers

Part B: **Performance evaluation**

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	________
Procedures completed correctly.	________
Proper tools used correctly.	________
Safety precautions observed.	________
Service meets specifications.	________
Clean-up and follow-up actions adequate.	________
Overall rating	________

Evaluator's comments ____

____

____

Job Sheet 3

Worksheet—Perform Routine Maintenance on Tillers

Name ______________________________ Attempt number __________

Date ______________________________

Part A: Pre-performance check

Job ______________________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________________

  Equipment model/type and code ______________________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________________

  Section/page number of procedure ______________________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________________

Job Sheet 3

Worksheet—Perform Routine Maintenance on Tillers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ______________________________

____

____

Job Sheet 4

Worksheet—Repair Tillers

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 4

Worksheet—Repair Tillers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

____

____

Job Sheet 5

Worksheet—Perform Routine Maintenance on Log Splitters

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

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Instructor's signature ______________________

Job Sheet 5

Worksheet—Perform Routine Maintenance on Log Splitters

Part B: **Performance evaluation**

Evaluation criteria **Rating**

Correct procedures identified for assigned equipment. ______

Procedures completed correctly. ______

Proper tools used correctly. ______

Safety precautions observed. ______

Service meets specifications. ______

Clean-up and follow-up actions adequate. ______

Overall rating ______

Evaluator's comments ____

____

____

Job Sheet 6

Worksheet—Repair Log Splitters

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 6

Worksheet—Repair Log Splitters

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

____

____

Job Sheet 7

Worksheet—Perform Routine Maintenance on Shredders

Name ______________________________ Attempt number __________

Date ______________________________

Part A: Pre-performance check

Job ______________________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________________

  Equipment model/type and code ______________________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________________

  Section/page number of procedure ______________________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________________

Job Sheet 7

Worksheet—Perform Routine Maintenance on Shredders

Part B: Performance evaluation

Evaluation criteria **Rating**

Correct procedures identified for assigned equipment. ________

Procedures completed correctly. ________

Proper tools used correctly. ________

Safety precautions observed. ________

Service meets specifications. ________

Clean-up and follow-up actions adequate. ________

Overall rating ________

Evaluator's comments ____

____

____

Job Sheet 8

Worksheet—Repair Shredders

Name ________________________ Attempt number __________

Date ________________________

Part A: Pre-performance check

Job ________________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ________________________

  Equipment model/type and code ________________________

  ____

- Complete the following service-manual information.

  Service-manual title ________________________

  Section/page number of procedure ________________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ________________________

Worksheet—Repair Shredders

Part B: Performance evaluation

Evaluation criteria	Rating
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

____

____

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Chain Saws
Unit 4

Suggested Activities

Instructional plan

Preparation

- Review unit and plan presentation. Study the specific objectives to determine the order in which you will present the objectives.

  Review the unit introduction and teaching suggestions included in the delivery and application section below, and plan classroom activities. Also note suggestions for media and supplemental materials.

  Plan presentation to take advantage of student learning styles and to accommodate special-needs students.

- Prepare the classroom by displaying posters, equipment, and tools related to chain saws and related equipment.
- Make transparencies from the transparency masters included in the teacher pages of this unit.
- Select teacher components (written test, unit evaluation form) you want to distribute to your students. Copy and prepare these components for distribution.
- Review the job sheets and worksheets in the student edition and locate the worksheet masters included in the teacher pages of this unit. Copy and prepare extra worksheets for distribution to your students.

Delivery and application

Unit introduction

The skill areas appearing in bold-face type in the unit introduction and teaching suggestions refer to the academic and workplace skills identified in *What Work Requires of Schools: A SCANS Report for America 2000* and *Workplace Basics: The Skills Employers Want.* These have been adapted by MAVCC.

- Provide students with copies of the student materials. You may choose to begin by discussing the objective sheet. Review the unit and specific objectives with the students. Discuss how meeting the unit objective will improve their employability or will increase their value as an employee. Explain how the specific objectives support the unit objective. **(Listening; adapting to the organization's traditional modes of operation; emphasizing personal and career development)**

Suggested Activities

Teaching suggestions

Objective 1 State the functions of the major components of chain saws.
Objective 2 Complete statements about the principles of operation of chain saws.

- Read and discuss with students the information presented in these sections of the information sheet. Use Transparency 1 to show the major components of chain saws. **(Reading/listening for content)**

- Display a variety of chain saws. Emphasize those designs used in your region or your facility. Discuss reasons for the differences in chain-saw designs and the suitability of design variations for various applications. Relate the operation of the components of chain saws to other types of equipment and basic systems theory, such as clutches, mechanical-drive principles, and lubrication systems. **(Listening; reasoning; seeing things in the mind's eye; system interrelationships)**

Objective 3 State the functions of the major components of chains.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 2 to show the major components of chains. **(Reading/listening for content)**

- Display actual chains, pointing out differences and similarities. Discuss advantages and disadvantages of each type of chain as related to specific applications. Discuss the role of each component in the operation of chain saws. Demonstrate chain assembly, emphasizing types of cutters and tie straps, rivets, etc. Allow the students to assemble chain as appropriate to your course objectives. **(Listening; reasoning; seeing things in the mind's eye; system interrelationships)**

Objective 4 Match parts of cutters to their correct definitions.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 3 to show the parts of cutters. **(Reading/listening for content)**

- Relate the parts of cutters to the information provided in the previous objective about the components of chains and to the next objective about the types of cutters. Compare, for example, the top plate of a chipper cutter to a chisel cutter. Discuss left- and right-hand configurations. **(Listening; reasoning; seeing things in the mind's eye; system interrelationships)**

Objective 5 Describe types of cutters.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 4 to show the types of cutters. **(Reading/listening for content)**

Suggested Activities

- Provide actual examples of each type of cutter: chipper, chisel, and power sharp. Discuss advantages and disadvantages of each type as related to specific applications. Note similarities and differences. Discuss the use of guard links and other differences due to cutter-design differences. **(Listening; seeing things in the mind's eye; system interrelationships)**

- Have students examine the cuts made by each type of cutter and the action of the cutter in the wood. Relate the cutting action to specific applications. Invite chain-saw professionals to discuss chain selection and the importance of maintaining properly sharpened cutters. **(Listening; system interrelationships)**

Objective 6 State the functions of the major components of guide-bar assemblies.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 5 to show the major components of guide-bar assemblies. **(Reading/listening for content)**

Objective 7 Label types of guide bars.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparencies 6 through 8 to aid the discussion. **(Reading/listening for content)**

- Discuss the design of each type of guide bar and reasons for variations in their designs. Relate the designs to different applications. Relate types of chains to the various guide bars. Discuss variations in designs for the types of guide bars, such as variations in rail design and the use of various types of nose rollers. Display worn guide bars and discuss the conditions that contribute to such wear. **(Listening; seeing things in the mind's eye; system interrelationships)**

Objective 8 List types of chain oilers.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparencies 9 through 11 to aid the discussion. **(Reading/listening for content)**

- Display the various types of chain oilers. Show both manual and automatic oilers and saws with both types of systems. Discuss the flow of oil from the reservoir to the guide bar. Review operator manuals to assess lubrication requirements, filling procedures, manual operation, and related factors. **(Listening; seeing things in the mind's eye)**

Objective 9 Complete statements about the principles of operation of pulsation-pump chain oilers.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 10 to aid the discussion. **(Reading/listening for content)**

- Follow up on the previous objective by concentrating on pulsation-type chain oilers. Provide additional details and specific studies related to this type of oiler. **(Listening; seeing things in the mind's eye; system interrelationships)**

Objective 10 Complete statements about the principles of operation of cam-operated-pump chain oilers.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 10 to aid the discussion. **(Reading/listening for content)**

- Continue the discussion of automatic oilers by discussing cam-operated oilers. Compare the operation of cam systems to pulsation-pump systems and discuss comparable service procedures. **(Listening; seeing things in the mind's eye; system interrelationships)**

Objective 11 Complete statements about the principles of operation of gear-driven-pump chain oilers.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 11 to aid the discussion. **(Reading/listening for content)**

- Continue the discussion of automatic oilers by discussing gear-driven-pump oilers. Compare the operation of gear-driven systems to cam-driven systems and to pulsation-pump systems, and discuss comparable service procedures. **(Listening; seeing things in the mind's eye; system interrelationships)**

Objective 12 Define types of chain drives.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparencies 12 and 13 to aid the discussion. **(Reading/listening for content)**

- Display actual equipment to describe the operation of types of chain drives. Show examples of both types, including variations in designs. Discuss the role of each part. Talk about variations in designs for drive sprockets, clutch systems, bearings, etc. Discuss advantages and disadvantages of each in specific applications. Display worn sprockets and discuss the conditions that contribute to such wear. Demonstrate related service procedures for each type of drive system. **(Listening; seeing things in the mind's eye; system interrelationships)**

Objective 13 List types of drive sprockets.

- Read and discuss with students the information presented in this section of the information sheet. Use Transparency 14 to aid your discussion of drive sprockets. **(Reading/listening for content)**

- Display actual equipment to provide examples of the various types of drive sprockets. Discuss advantages and disadvantages of each in specific applications. Display sprockets of various materials. Relate the drive sprockets to drive systems. Discuss applicable service procedures and equipment, and the costs of these items. **(Listening; seeing things in the mind's eye; system interrelationships)**

Objective 14 Define types of hazards associated with chain-saw operation.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Use available media or invite a chain-saw sales representative to demonstrate the three major operational hazards of chain saws: kickback, pushback, and pull-in. Discuss the conditions that can increase the likelihood of each of the hazards. Point out safety features of modern chain saws used to reduce these hazards, and discuss the importance of leaving such safeguards in place. Reinforce the need for students to understand these hazards both because they will need to operate chain saws in order to service them and because these hazards can lead to specific types of damage and wear in the equipment that technicians need to be able to recognize. **(Listening; seeing things in the mind's eye; system interrelationships)**

Objective 15 State safety rules for servicing chain saws.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Demonstrate the proper starting and operation of a chain saw. Discuss procedures for routine service, such as refueling and adjusting the chain tension and related safety considerations. Provide the students with operator manuals, particularly those for the equipment in your facility. Review the safety sections of each manual. Invite medical personnel who have worked with chain-saw injuries or those who have suffered such injuries to discuss the dangers of chain-saw operation. **(Listening; seeing things in the mind's eye; system interrelationships)**

Objective 16 List protective equipment to be worn during chain-saw service.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Display actual equipment to provide examples of the proper type of clothing and protective equipment that should be used when operating a chain saw. Point out the dangers of overly loose and overly tight clothing. Have the class divide into pairs and evaluate the appropriateness of each other's clothing for chain-saw operation. Point out equipment labeling, such as Underwriter's Laboratories and other standards organizations' ratings. Discuss how poorly made protective equipment can increase the hazards of chain-saw operation. **(Listening; reasoning; seeing things in the mind's eye; interpreting and processing information)**

Objective 17 State the functions of the specialty tools used in chain-saw service.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Display actual equipment to assist with the discussion. Demonstrate the design and operation of each type of tool. Point out similarities and differences in design variations for the same type of tool. Discuss the advantages and disadvantages of each in specific applications and describe common applications of each type. Where appropriate, relate tools to specific equipment, such as files that are suited for particular cutters and breaking tools appropriate for types of chains and rivets. **(Listening; seeing things in the mind's eye; system interrelationships)**

Objective 18 List typical service procedures required for chain saws.

- Read and discuss with students the information presented in this section of the information sheet. **(Reading/listening for content)**

- Discuss and demonstrate the service procedures presented in the objective. **(Listening; seeing things in the mind's eye; system interrelationships)**

Assignment Sheet 1 Calculate fuel-mix ratios.

- Have students locate Assignment Sheet 1. Read the introduction and directions to the assignment. **(Reading/listening for direction)**

- Make resources available that will allow the students to determine the required information. Tailor the assignment sheet to equipment used in your facility. **(Listening; reasoning; writing; acquiring, organizing, interpreting, and processing information; system interrelationships)**

- Answer any student questions and have students complete Assignment Sheet 1.

Assignment Sheet 2 Calculate chain pitch.

- Have students locate Assignment Sheet 2. Read the introduction and directions to the assignment. **(Reading/listening for direction)**

- Make resources available that will allow the students to determine the required information. Tailor the assignment sheet to equipment used in your facility. **(Listening; reasoning; writing; acquiring, organizing, interpreting, and processing information; system interrelationships)**

- Answer any student questions and have students complete Assignment Sheet 2.

Suggested Activities

Assignment Sheet 3 Determine chain-saw service specifications and parts requirements.

- Have students locate Assignment Sheet 3. Read the introduction and directions to the assignment. **(Reading/listening for direction)**

- Make resources available that will allow the students to determine the required information. Tailor the assignment sheet to equipment used in your facility. **(Listening; reasoning; writing; acquiring, organizing, interpreting, and processing information; system interrelationships)**

- Answer any student questions and have students complete Assignment Sheet 3.

Assignment Sheet 4 Troubleshoot poor performance in chain saws.

- Have students locate Student Supplement 1 and Assignment Sheet 4. Have your students read Student Supplement 1 and then discuss the troubleshooting information found in the supplement. Read the introduction and directions to the assignment. **(Reading/listening for content and direction; seeing things in the mind's eye; reasoning)**

- Make additional resources available that will allow the students to determine the required information. Tailor the assignment sheet to equipment used in your facility. **(Listening; reasoning; writing; acquiring, organizing, interpreting, and processing information; system interrelationships)**

- Answer any student questions and have students complete Assignment Sheet 4.

Job Sheet 1 Perform routine maintenance on chain saws.

- Have students locate Job Sheet 1 and the worksheet associated with the job sheet. Demonstrate the procedures for performing routine maintenance on chain saws. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

- Provide students with chain saws that require routine maintenance and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 1.

Job Sheet 2 Repair chain saws.

- Have students locate Job Sheet 2 and the worksheet associated with the job sheet. Demonstrate the procedures for repairing chain saws. Review with students the worksheet associated with the job sheet, and have them obtain copies of the worksheet for each attempt that will be required.

Suggested Activities

- Provide students with chain saws that require repair and have them complete the pre-performance check (Part A) on the worksheet. Evaluate the pre-performance check, and when a student has completed it satisfactorily, have him/her complete Job Sheet 2.

Evaluation

- Evaluate the assignment sheets. See the evaluation criteria listed at the top of each assignment sheet as well as the teacher page "Answers to Assignment Sheets."
- Evaluate the job sheets.

  When the student is ready to perform a specific task, obtain a copy of the worksheet associated with each job sheet. Worksheets may be found in the student edition and in the teacher pages following the transparency masters. Then, observe the student performing the procedure.

  After the student has completed the procedure, rate the student using the criteria provided on the worksheet. If the student's performance is unacceptable, have the student review the materials and perform the procedure again for evaluation.

  Two sample performance evaluation keys are provided below. Many other keys are available. Select one evaluation key (grading scale) that best fits your program needs.

Performance Evaluation Keys

Sample A

4 — Skilled—Can perform job with no additional training.
3 — Moderately skilled—Has performed job during training program; limited additional training may be required.
2 — Limited skill—Has performed job during training program; additional training is required to develop skill.
1 — Unskilled—Is familiar with process, but is unable to perform job.

Sample B

Yes—Can perform job with no additional training.

No—Is unable to perform job satisfactorily.

- Give the written test. See the teacher page "Written Test."
- Evaluate the written test. See the teacher page "Answers to Written Test."
- Compile written-test, assignment-sheet, and job-sheet scores. See the teacher page "Unit Evaluation Form."
- Reteach and retest as required.

Suggested resources

Resources used in developing this unit

Print media

- *Chain Saw Repair,* 2nd ed. Stillwater, Oklahoma: Mid-America Vocational Curriculum Consortium, 1985.
- *Chain Saw Service Manual,* 9th ed. Overland Park, Kansas: Intertec Publishing Corporation, 1993.
- Graf, Rudolf F., and George J. Whalen. *VNR Illustrated Guide to Power Tools.* New York: Van Nostrand Reinhold Company, 1978.
- *Power Tools and Equipment.* Alexandria, Virginia: Time-Life Books, Inc., 1989.

Suggested supplemental resources

Print media

- *Power Equipment Trade* magazine. Hatton-Brown Publishers, Inc., P.O. Box 2268, Montgomery, Alabama 36102.
- Service manuals for systems covered in this unit.
- Parts catalogs for systems covered in this unit. Available from equipment manufacturers.

Non-print media

- *The Physical World of a Machine.* Tel-A-Train, 309 North Market Street, P.O. Box 4752, Chattanooga, Tennessee 37405, (615) 624-2628.
- *Roller Chain.* Tel-A-Train, 309 North Market Street, P.O. Box 4752, Chattanooga, Tennessee 37405, (615) 624-2628.

Chain Saws
Unit 4

Answers to Assignment Sheets

Assignment Sheet 1—Student performance should be evaluated according to the criteria listed on the assignment sheet. Content of each item in the exercise may be evaluated using the following suggestions as guides.

1. 1 pint/16 ounces
2. 1 pint/16 ounces
3. 2½ gallons
4. 1 pint/16 ounces
5. 2 pints/32 ounces

Assignment Sheet 2—Student performance should be evaluated according to the criteria listed on the assignment sheet. Content of each item in the exercise may be evaluated using the following suggestions as guides.

1. $\frac{7}{16}$ inch
2. ¾ inch
3. ½ inch
4. $\frac{9}{16}$ inch
5. ⅜ inch

Assignment Sheet 3—Student performance should be evaluated according to the criteria listed on the assignment sheet. Answers will vary according to the equipment selected by the instructor.

Assignment Sheet 4—Student performance should be evaluated according to the criteria listed on the assignment sheet. Content of each item in the exercise may be evaluated using the following suggestions as guides.

1. Clean the needle valve
2. No, the typical cutting-edge angle of chipper cutters is 35 degrees. Yes, this may be causing the problem.
3. Inconsistent face angles
4. The metering valve is set too high; adjust the metering lever.
5. A closed inlet port causes poor lubrication, which resulted in the chain failure

Chain Saws
Unit 4

Answers to Written Test

1.
   - a. Allows the operator to hold the saw and to actuate the throttle control
   - b. Turns the engine flywheel to start the internal-combustion process
   - c. Provides access to the tank in which the fuel is stored to operate the engine
   - d. Provides the operator with a second handhold to provide better control of the saw
   - e. Allows the operator to lubricate the chain manually
   - f. Provides access to the tank from which oil is dispensed to lubricate the moving chain
   - g. Cuts wood
   - h. Provides the track in which the chain travels
   - i. Tightens or loosens the chain
   - j. Engages or disengages the chain drive sprocket
   - k. Provides the power to drive the chain
   - l. Regulates the flow of fuel to the air/fuel mixture
   - m. Allows the operator to enrich the air/fuel mixture when starting a cold engine
   - n. Allows the operator to stop the engine when it is operating

2.
   - a. pull-recoil starter
   - b. clutch; drive sprocket
   - c. drive sprocket
   - d. cutters
   - e. Oil
   - f. clutch; drive sprocket

3.
   - a. Connects the drive links and cutters
   - b. Connects the drive links and cutters and has rivets to attach to the other components
   - c. Meshes with the sprocket teeth to drive the chain around the guide bar
   - d. Contains the cutting edge
   - e. Fastens the other components together

4.
   - a. 8
   - b. 3
   - c. 4
   - d. 1
   - e. 5
   - f. 2
   - g. 10
   - h. 6
   - i. 9
   - j. 7

5.
   - a. General-purpose cutter that provides a medium depth of cut
   - b. Cutter that provides a shallow depth of cut for extremely hard woods
   - c. Cutter that provides a deep depth of cut for soft woods

6.
   - a. Provides the basic structure for the guide bar
   - b. Form the groove and provide the surface on which the tie straps of the chain ride
   - c. Guides the drive links around the guide bar
   - d. Assists in changing the direction of travel of the chain at the end of the guide bar
   - e. Secure the adjusting pins to the guide bar
   - f. Route lubricant from the oil tank to the groove to reduce friction along the drive-link path
   - g. Accommodates the hardware used to secure the guide bar to the chain saw and allows movement of the guide bar to adjust chain tension

7. **Shape of the guide bar**

   a. Bow shape
   b. Standard shape
   c. Banana shape

   Type of nose tip

   a. Solid nose tip
   b. Internal-roller nose tip
   c. External-roller nose tip

   Replaceability of nose tip

   a. Fixed, solid nose tip
   b. Replaceable, solid nose tip
   c. Fixed, roller nose tip
   d. Replaceable, roller nose tip

8. Answers may appear in any order.

   - Manual
   - Automatic
   - Combination automatic with manual

9. a. compression
   b. crankcase
   c. opens; metering
   d. block
   e. metering
   f. open

10. a. cylinder
    b. plunger
    c. reduced
    d. inlet port
    e. check valve
    f. metering
    g. opening; close
    h. pump

11. a. gear; gear
    b. groove; cam screw
    c. bottom
    d. oil
    e. closed
    f. outlet

Answers to Written Test

12. a. Chain drive using a clutch-and-sprocket assembly to transfer power from the crankshaft to the chain
    b. Chain drive using mated gears designed to reduce the output speed and increase the torque of the system before it is applied to the work

13. Answers may appear in any order.

    - Integral-star sprocket and clutch drum
    - Self-aligning sprocket
    - Gear-drive sprocket

14. a. Upward motion of the guide bar that occurs when the chain at the nose of the guide bar is suddenly stopped or pinched or contacts a solid object in the wood
    b. Backward motion of the saw—toward the operator—that occurs when the chain on top of the guide bar is suddenly stopped or pinched or contacts a solid object in the wood
    c. Forward motion of the saw—away from the operator—that occurs when the chain at the nose of the guide bar is suddenly stopped or pinched or contacts a solid object in the wood

15. a. Read the service or owner's manual and follow the safety guidelines included in the publication.
    b. Wear proper safety equipment.
    c. Place the chain saw on a solid surface to start it.
    d. Never operate a chain saw with a loose chain.
    e. Never carry a chain saw from place to place while the saw is running.
    f. Always carry a chain saw with the guide bar pointing toward the rear.
    g. Always keep both hands on the chain-saw grips while the saw is running.
    h. Follow the manufacturer's directions for using the specialty tools required for chain-saw service.

16. Answers may appear in any order.

    - Protective clothing
    - Heavy-duty, non-slip-design gloves
    - Heavy-duty, steel-toed safety boots with non-skid soles
    - Eye protection
    - Head gear
    - Industrial-quality ear muffs or shooter's ear plugs

17. a. Used to hold the chain so that it can be filed and to help achieve a good angle for filing
    b. Used to maintain a proper profile on the drive links and cutters and to create a good cutting edge or shaped face, such as the curve of a drive-link hook
    c. Used to help the technician maintain a correct angle when sharpening the cutters so that each plate is filed in the same way
    d. Used to shape and sharpen cutters and to shape drive links and other chain parts
    e. Used to install rivets when assembling chains
    f. Used to remove rivets from assembled chains
    g. Used to remove rivets and to install rivets by hand operation
    h. Used to remove rivets and to install rivets as a fixed shop tool

Answers to Written Test

18. Answer should include any eight of the following.

    - Service engine, including carburetor adjustment and repair
    - Replace chain
    - Sharpen or reshape chain components
    - Shorten chain
    - Repair guide bar
    - Replace guide bar
    - Replace replaceable components of guide bar
    - Lubricate guide-bar rollers
    - Debur guide-bar rollers
    - Repair clutch and sprocket components
    - Replace clutch and sprocket components
    - Pack or lubricate clutch bearings
    - Repair oiler
    - Replace oiler
    - Repair rewind starter
    - Replace rewind starter
    - Service support components

Chain Saws
Unit 4

Written Test

Name ______________________________ Score ______________

1. State the functions of the major components of chain saws. Write your answers on the blanks provided beside each of the terms below.

   a. Rear grip ______________________________

   b. Pull starter ______________________________

   c. Fuel-tank cap ______________________________

   d. Top grip ______________________________

   e. Oiler actuator ______________________________

   f. Oil-tank cap ______________________________

   g. Chain ______________________________

   h. Guide bar ______________________________

   i. Chain-tension adjuster ______________________________

   j. Clutch ______________________________

   k. Engine ______________________________

l. Throttle control ____

____

m. Choke control ____

____

n. Stop control ____

____

2. Complete statements about the principles of operation of chain saws. Write the missing word(s) on the blanks provided in the following statements.

a. A __________________ starter is used to start the engine.

b. When the operator squeezes the throttle control, the engine speed increases; when the engine speed is great enough, the __________________ engages the __________________ and causes it to rotate.

c. The rotation of the __________________ drives the chain, which travels in a continuous loop around the guide bar.

d. The __________________ on the chain cut wood by slicing under a section of wood and breaking off the chip that is formed.

e. __________________ is manually or automatically dispensed onto the chain as it exits the housing to lubricate the chain and bar as the chain goes around the guide bar.

f. When the throttle control is released, the engine speed drops to the point that the __________________ disengages from the __________________.

3. State the functions of the major components of chains. Write your answers on the blanks provided beside each of the terms below.

a. Side-link tie strap ____

____

b. Preset tie strap ____

____

c. Drive link ____

____

d. Preset cutter ____

____

e. Rivet ____

____

4. Match the parts of cutters to their correct definitions. Write the numbers on the blanks.

_______ a. Leading portion of the cutter body

_______ b. Angle of the cutting edge as compared to the centerline of the chain length

_______ c. Vertical portion of the cutting-edge structure

_______ d. Leading edge of the cutter that allows the cutting edge to enter to a desired depth into the surface being cut

_______ e. Horizontal portion of the cutting-edge structure

_______ f. Distance between the top of the cutter and the top of the depth gauge

_______ g. Recessed area in the edge of the cutter body between the heel and the toe

_______ h. Recessed area between the cutting-edge structure and the depth gauge

_______ i. Trailing portion of the cutter body

_______ j. Drilled hole through which the rivet flange is inserted

1. Depth gauge
2. Joint clearance
3. Cutter angle
4. Side plate
5. Top plate
6. Gullet
7. Rivet hole
8. Toe
9. Heel
10. Notch

5. Describe types of cutters. Write your answers on the blanks provided beside each of the terms below.

a. Chipper ____

____

b. Chisel ____

____

c. Power sharp ____

____

6. State the functions of the major components of guide-bar assemblies. Write your answers on the blanks provided beside each of the terms below.

   a. Body ____

   ____

   b. Rails ____

   ____

   c. Groove ____

   ____

   d. Nose tip ____

   ____

   e. Adjustment-pin holes ____

   ____

   f. Oil-delivery holes ____

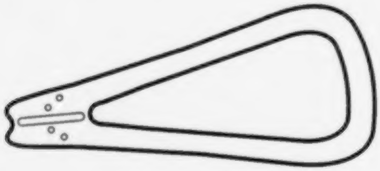
   ____

   g. Mounting slot ____

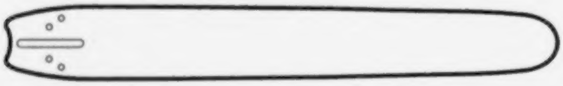
   ____

7. Label types of guide bars. Write your answers on the blank line under each of the following illustrations.

   - **Shape of the guide bar**

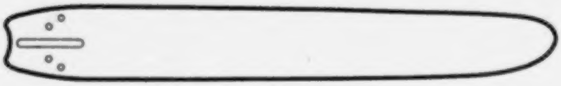


a. ____



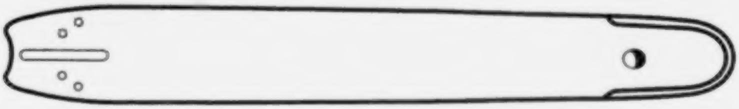
b. ____

238

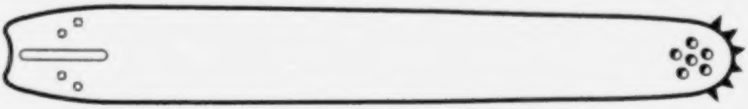


c. ____

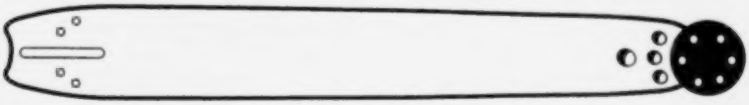
- **Type of nose tip**



a. ____

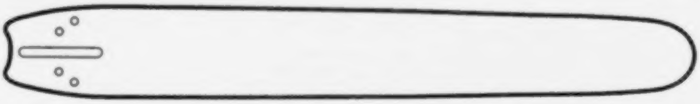


b. ____

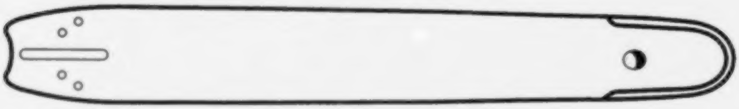


c. ____

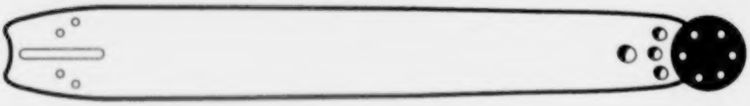
- **Replaceability of nose tip**



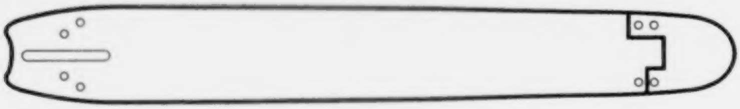
a. ____



b. ____



c. ______________________________



d. ______________________________

8. List types of chain oilers. Write your answers on the blanks provided below.

   a. ______________________________

   b. ______________________________

   c. ______________________________

9. Complete statements about the principles of operation of pulsation-pump chain oilers. Write the missing word(s) on the blanks provided in the following statements.

   a. The movement of the piston during ________________ creates low pressure in the crankcase.

   b. The chain-oiler diaphragm is vented to ________________ pressure on one side so that the diaphragm is pulled toward the crankcase when the pressure in the crankcase is low.

   c. The diaphragm is connected to the pump piston, which moves with the diaphragm; the movement of the piston toward the crankcase ________________ the oil-inlet port and draws oil from the tank into the ________________ chamber due to the decreasing pressure.

   d. As the crankcase pressure builds during the return stroke of the piston, the diaphragm is pushed away from the crankcase, causing the pump piston to return in its cylinder and to ________________ the oil inlet.

   e. The continued return movement of the piston pressurizes the ________________ chamber, which overcomes the resistance of the check-valve spring so that the check valve moves off its seat.

f. With the check valve __________________, the oil is forced past the valve and through the transfer line to the guide bar.

10. Complete statements about the principles of operation of cam-operated-pump chain oilers. Write the missing word(s) on the blanks provided in the following statements.

    a. Oil from the tank accumulates in the pick-up hose and flows into the pump __________________.

    b. The operation of the engine rotates a cam so that the eccentric of the cam pushes a __________________.

    c. When the pressure of the cam overcomes the resistance of the piston spring, the piston moves in the cylinder, pushing the accumulated oil and drawing in additional oil due to the __________________ pressure.

    d. Oil continues to flow into the cylinder until the piston moves past the __________________.

    e. The movement of the piston also pressurizes the oil and forces the __________________ off its seat.

    f. Oil moves into the __________________ chamber and is transferred through the outlet port to the guide bar.

    g. The continued rotation of the cam moves the eccentric off the plunger so that the piston spring returns the piston and plunger, __________________ the oil-inlet port and allowing the check valve to __________________.

    h. Oil enters the __________________ cylinder from the tank reservoir.

11. Complete statements about the principles of operation of gear-driven-pump chain oilers. Write the missing word(s) on the blanks provided in the following statements.

    a. A __________________ on the crankshaft drives a __________________ on the pump shaft as the engine operates.

    b. A __________________ in the pump shaft rides on a __________________, allowing the pump shaft to move up and down as it rotates in the oil chamber.

    c. A flat on the lower end of the pump shaft allows oil to flow into the chamber at the __________________ of the shaft.

d. As the shaft continues to rotate, it also moves up in the chamber, causing a pressure reduction in the bottom of the chamber, which draws ________________ into the chamber.

e. After one-quarter turn, the pump shaft reaches its fully up position and the flat faces the side wall of the chamber so that both the inlet port and the outlet port are ________________.

f. The continued rotation of the shaft moves the flat to face the outlet port as the shaft begins to move down in the chamber; simultaneously, the downward motion of the shaft forces the oil through the ________________, from which it is delivered to the guide bar.

12. Define types of chain drives. Write your answers on the blanks provided beside each of the terms below.

a. Direct ____

____

b. Gear reduction ____

____

13. List types of drive sprockets. Write your answers on the blanks provided below.

a. ____

b. ____

c. ____

14. Define types of hazards associated with chain-saw operation. Write your answers on the blanks provided beside each of the terms below.

a. Kickback ____

____

b. Pushback ____

____

c. Pull-in ____

____

15. State safety rules for servicing chain saws. Write the complete safety rule on the blanks provided beside each of the terms below.

    a. Reading the manuals

    b. Safety equipment

    c. Starting a chain saw

    d. Loose chain

    e. Carrying a running chain saw

    f. Positioning the guide bar when carrying a chain saw

    g. Hand position while the chain saw is running

    h. Using specialty tools

16. List the protective equipment to be worn during chain-saw service. Write your answers on the blank lines provided below.

    a.

    b.

    c.

    d.

    e.

    f.

17. State the functions of the specialty tools used in chain-saw service. Write your answers on the blanks provided beside each of the terms below.

    a. Chain-filing vise ______________________________

    ____

    b. Full-round file ______________________________

    ____

    c. File guide ______________________________

    ____

    d. Power grinder ______________________________

    ____

    e. Hand-operated rivet spinner ______________________________

    ____

    f. Pocket-sized chain breaker ______________________________

    ____

    g. Multi-purpose tool ______________________________

    ____

    h. Bench chain breaker and spinner ______________________________

    ____

18. List eight of the typical service procedures required for chain saws. Write your answers on the blanks provided below.

    a. ______________________________
    b. ______________________________
    c. ______________________________
    d. ______________________________
    e. ______________________________
    f. ______________________________
    g. ______________________________
    h. ______________________________

Permission to duplicate this test is granted.

Chain Saws
Unit 4

Unit Evaluation Form

Student name ______________________ Unit rating ____________

Assignment-sheet ratings

Assignment Sheet 1—Calculate Fuel-Mix Ratios Rating ________

Comments: ______________________

Assignment Sheet 2—Calculate Chain Pitch Rating ________

Comments: ______________________

Assignment Sheet 3—Determine Chain-Saw Service Specifications and Parts Requirements Rating ________

Comments: ______________________

Assignment Sheet 4—Troubleshoot Poor Performance in Chain Saws Rating ________

Comments: ______________________

Job-sheet ratings

Job Sheet 1—Perform Routine Maintenance on Chain Saws Rating ________

Comments: ______________________

Job Sheet 2—Repair Chain Saws Rating ________

Comments: ______________________

Unit Evaluation Form

Written-test scores

Pretest ______ Posttest ______ Other ______

Comments: ____

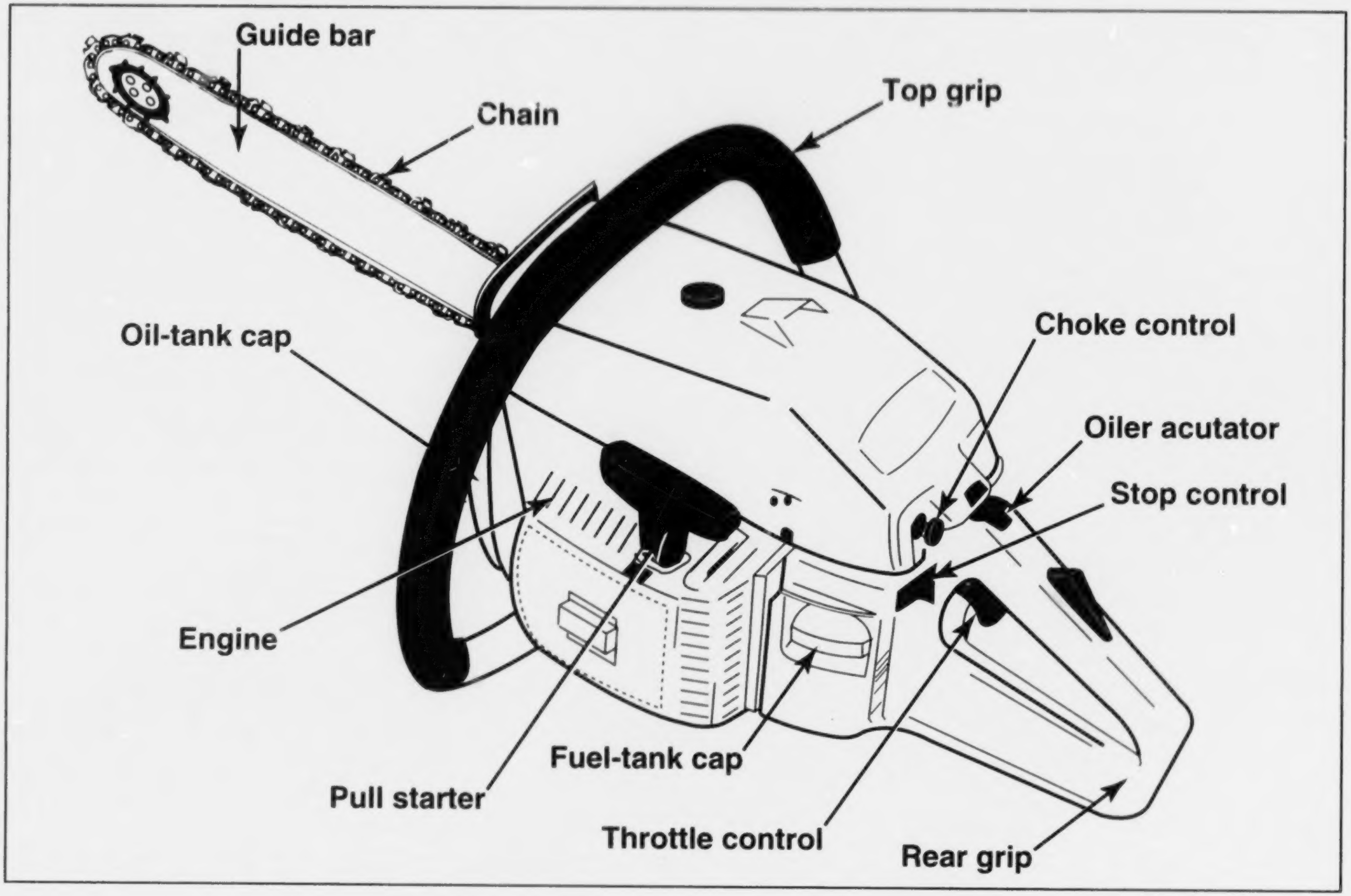
____

Teacher signature ____________________ Date ____________

Student signature ____________________ Date ____________

Permission to duplicate this form is granted.

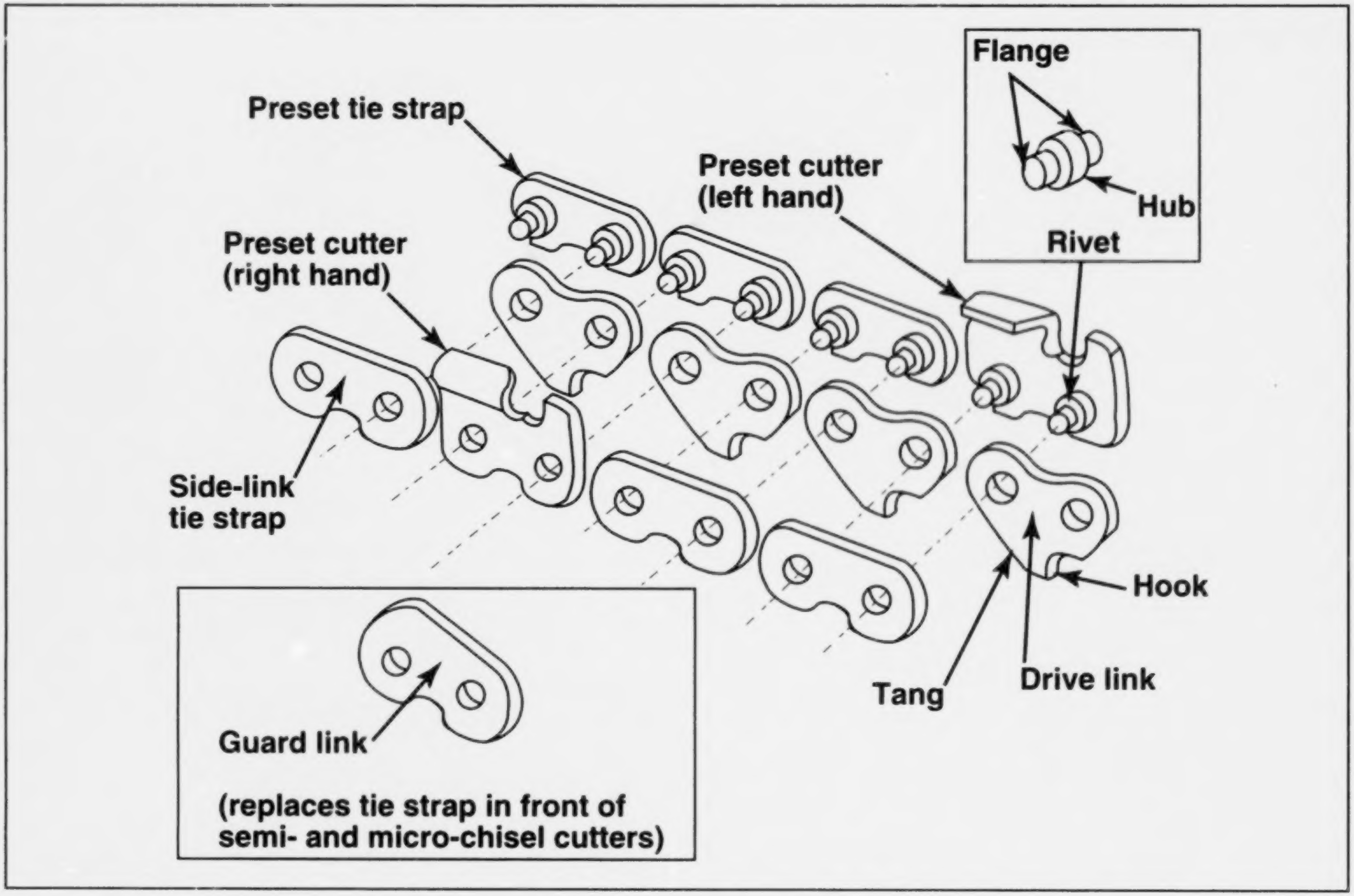
Major Components of Chain Saws


Guide bar
Chain
Top grip
Oil-tank cap
Choke control
Oiler acutator
Stop control
Engine
Fuel-tank cap
Pull starter
Throttle control
Rear grip

Lawn and Garden Equipment, Unit 4
Teacher Page 215

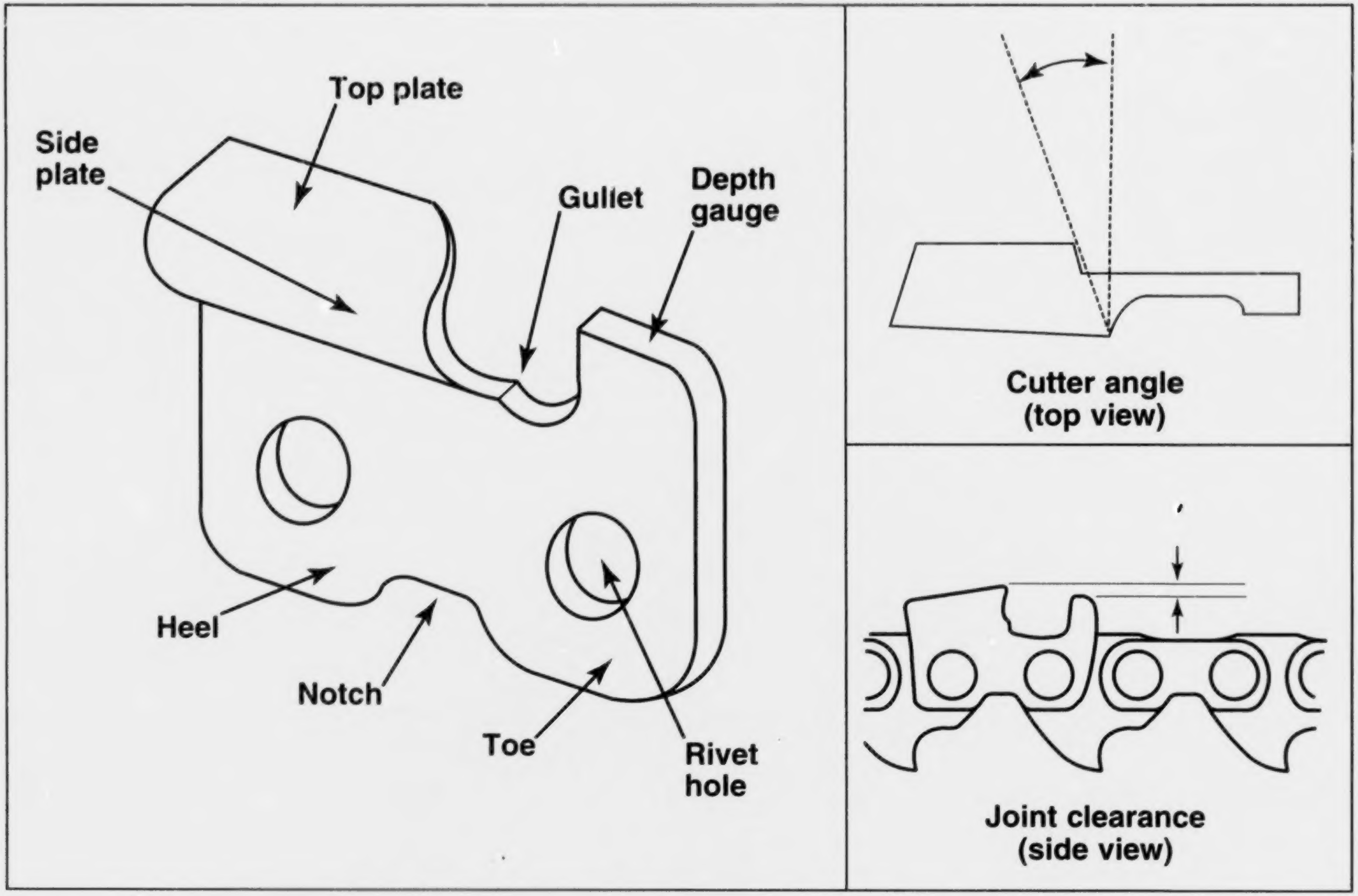
TM 1

Components of Chains


Flange
Hub
Rivet
Preset tie strap
Preset cutter (left hand)
Preset cutter (right hand)
Side-link tie strap
Hook
Drive link
Tang
Guard link

(replaces tie strap in front of semi- and micro-chisel cutters)

Parts of Cutters

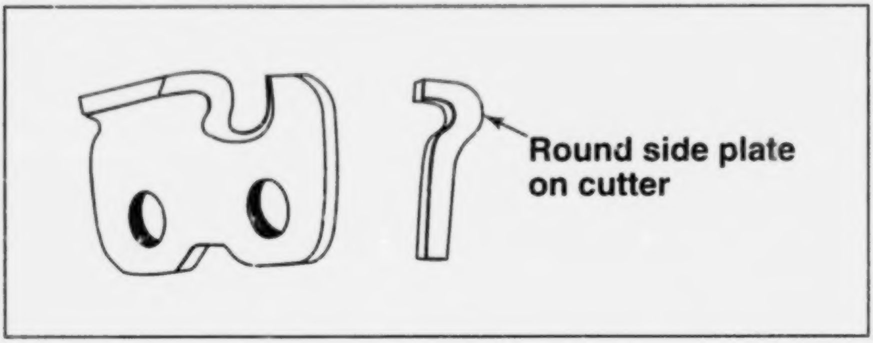

Top plate
Side plate
Gullet
Depth gauge
Heel
Notch
Toe
Rivet hole

Cutter angle (top view)

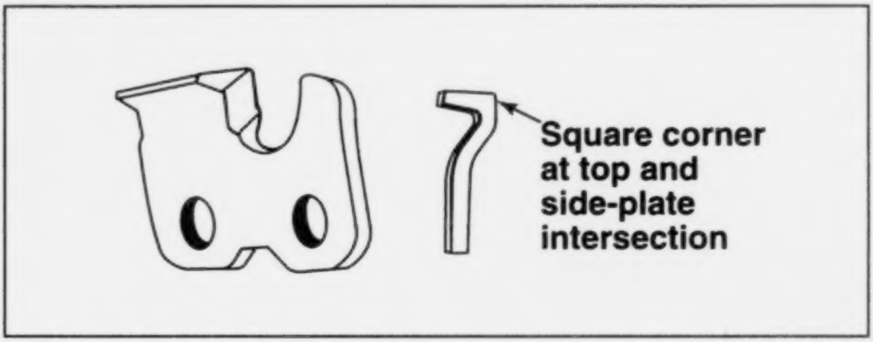
Joint clearance (side view)

TM 3

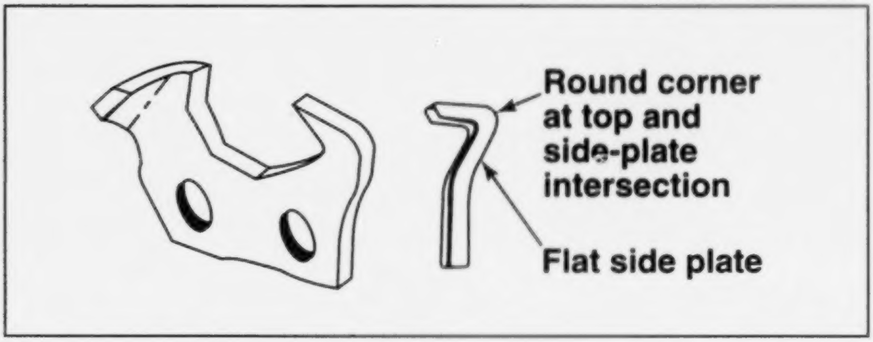
Types of Cutters


Round side plate on cutter

Chipper Cutter


Square corner at top and side-plate intersection

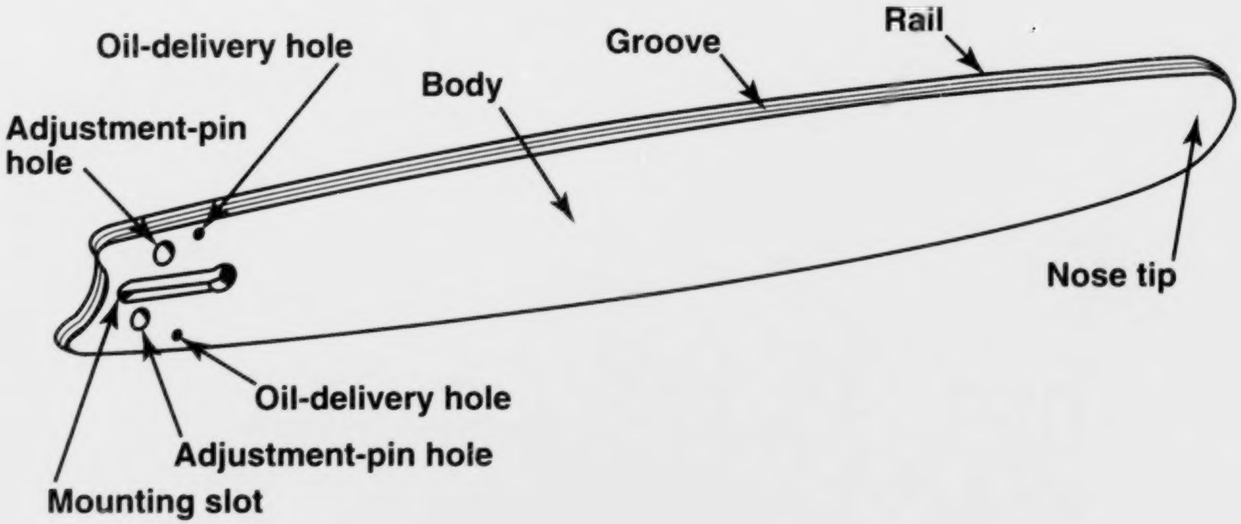
Chisel Cutter


Round corner at top and side-plate intersection
Flat side plate

Power-Sharp Cutter

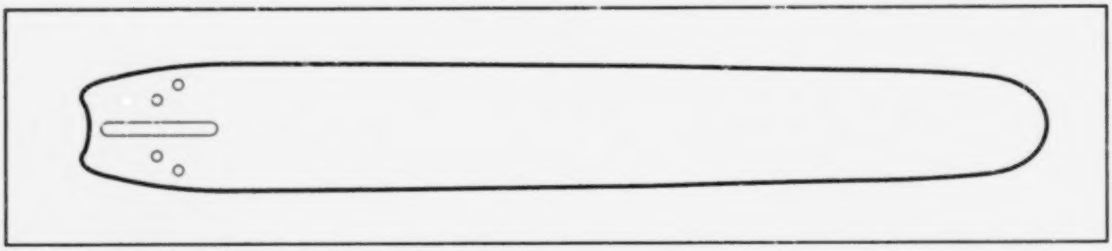
TM 4

Major Components of Guide-Bar Assemblies

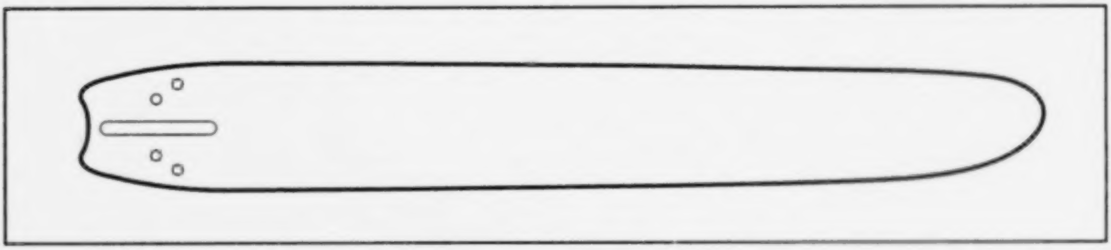

Rail
Groove
Oil-delivery hole
Body
Adjustment-pin hole
Nose tip
Oil-delivery hole
Adjustment-pin hole
Mounting slot

Types of Guide Bars:

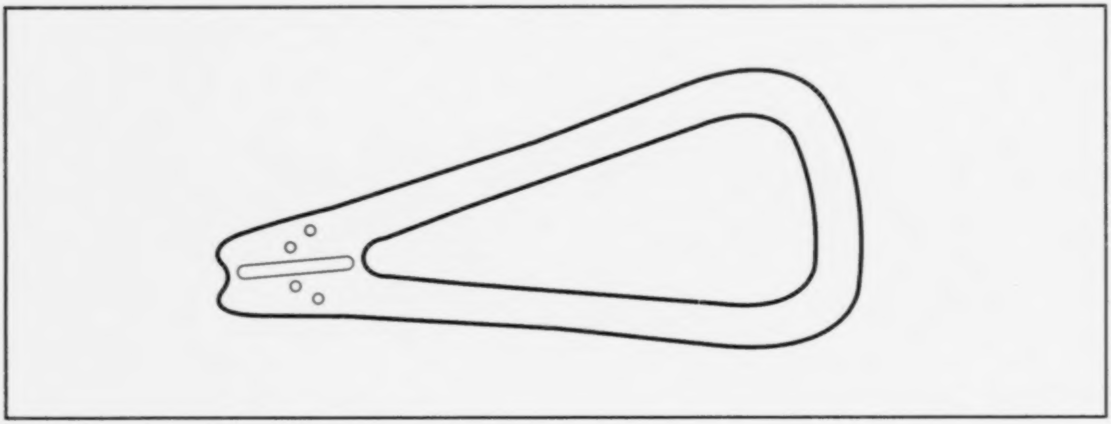
Guide-Bar Shapes



Standard Shape



Banana Shape

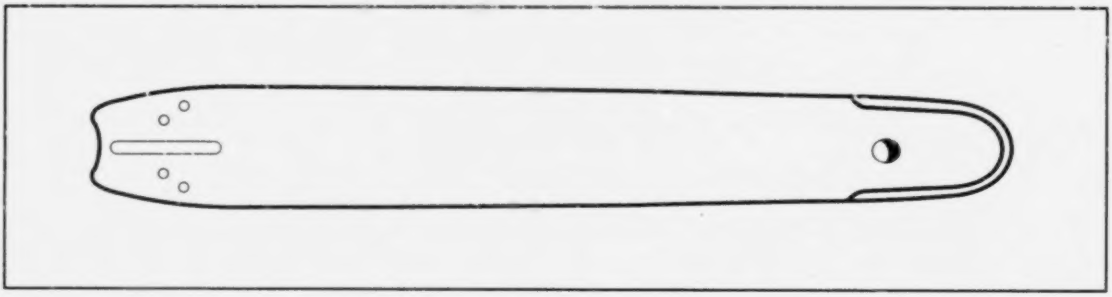


Bow Shape

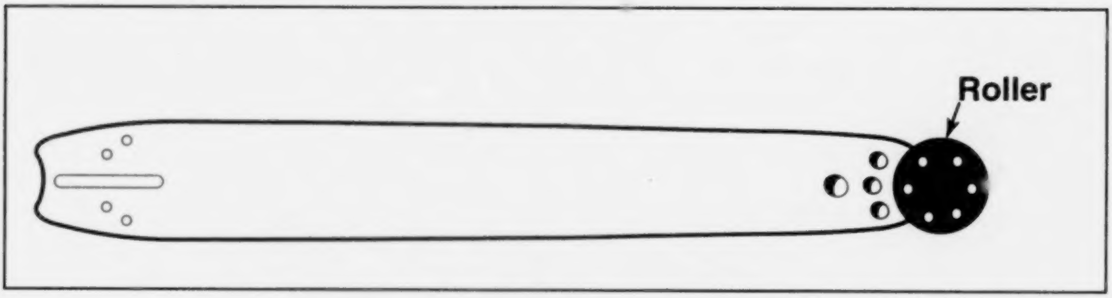
TM 6

Types of Guide Bars:

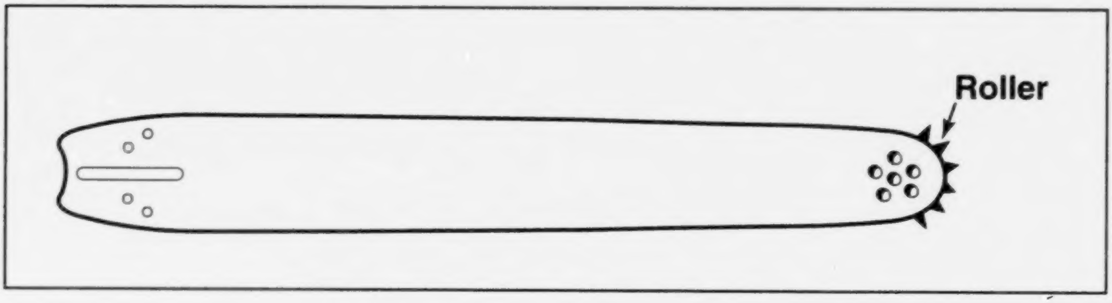
Nose-Tip Types



Solid Nose Tip



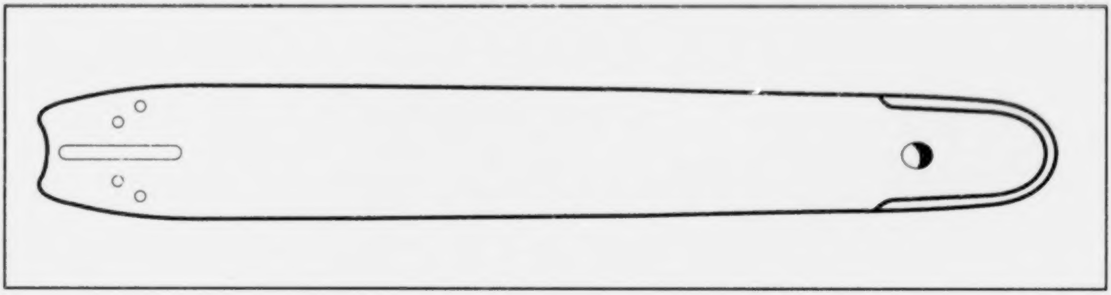
External-Roller Nose Tip



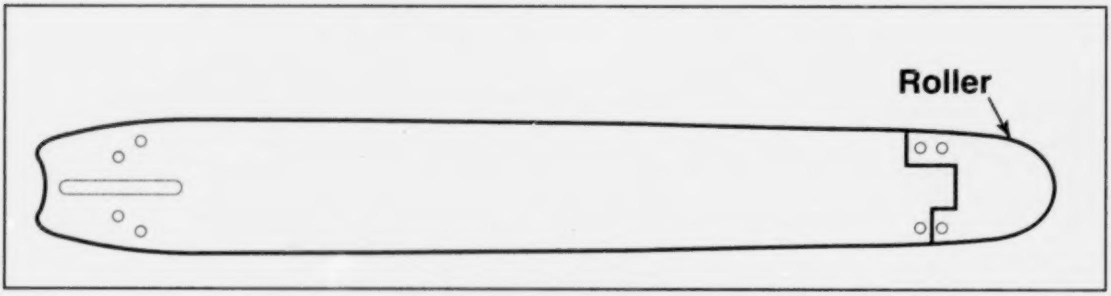
Internal-Roller Nose Tip

Types of Guide Bars:

Types of Replaceable Nose Tips



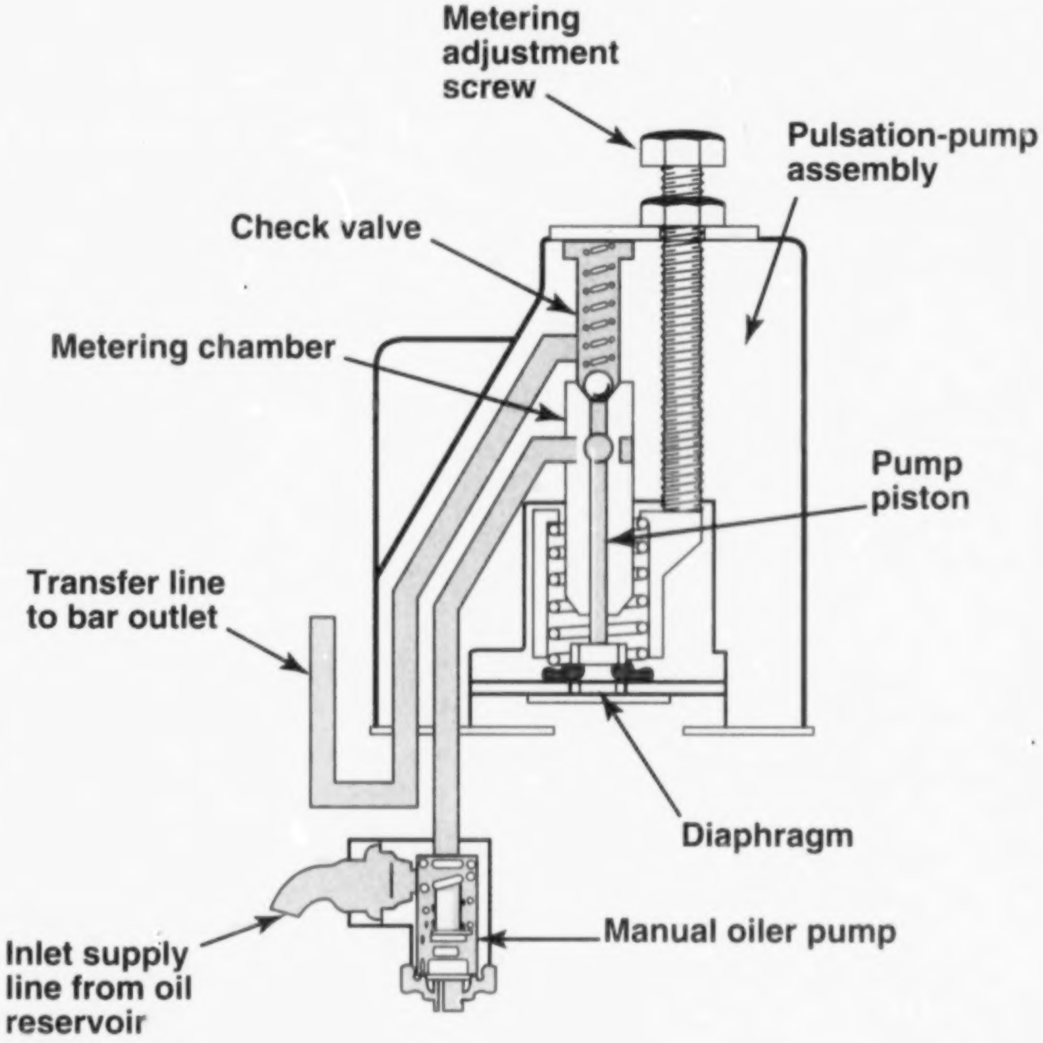
Replaceable, Solid Nose Tip



Replaceable, Roller Nose Tip

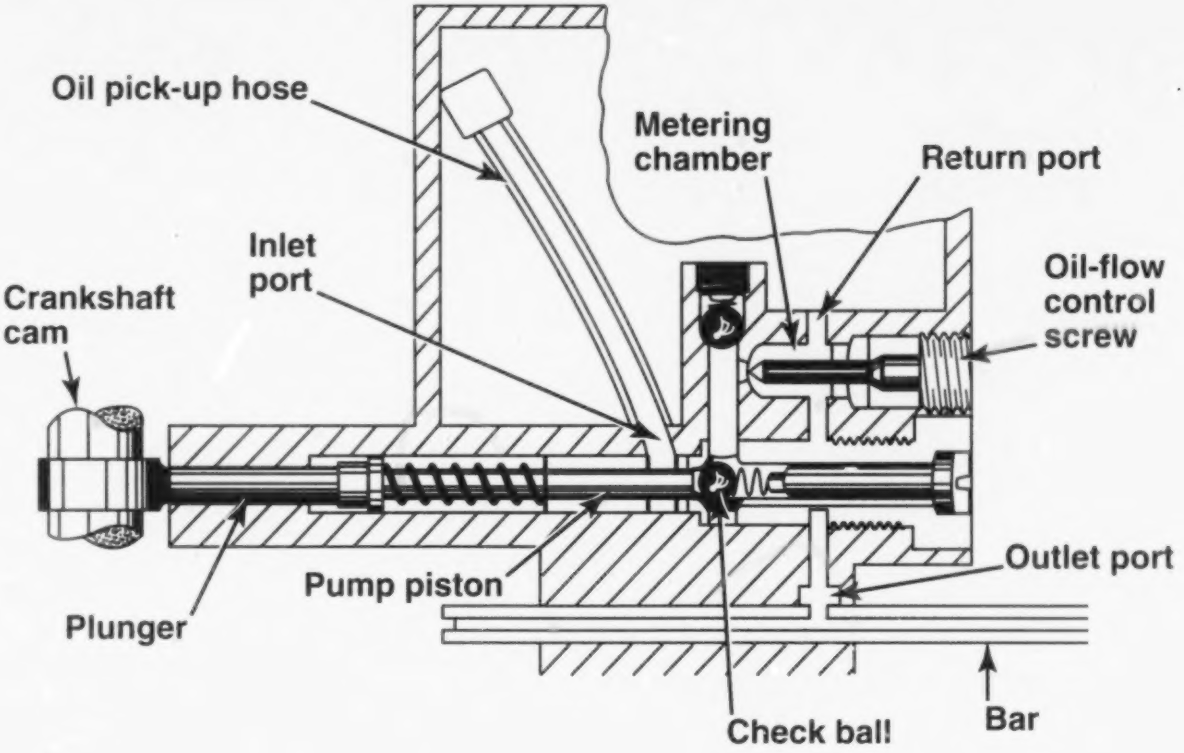
Types of Chain Oilers:

Pulsation-Pump Chain Oiler


Metering adjustment screw
Pulsation-pump assembly
Check valve
Metering chamber
Pump piston
Transfer line to bar outlet
Diaphragm
Manual oiler pump
Inlet supply line from oil reservoir

Types of Chain Oilers:

Cam-Operated-Pump Chain Oiler

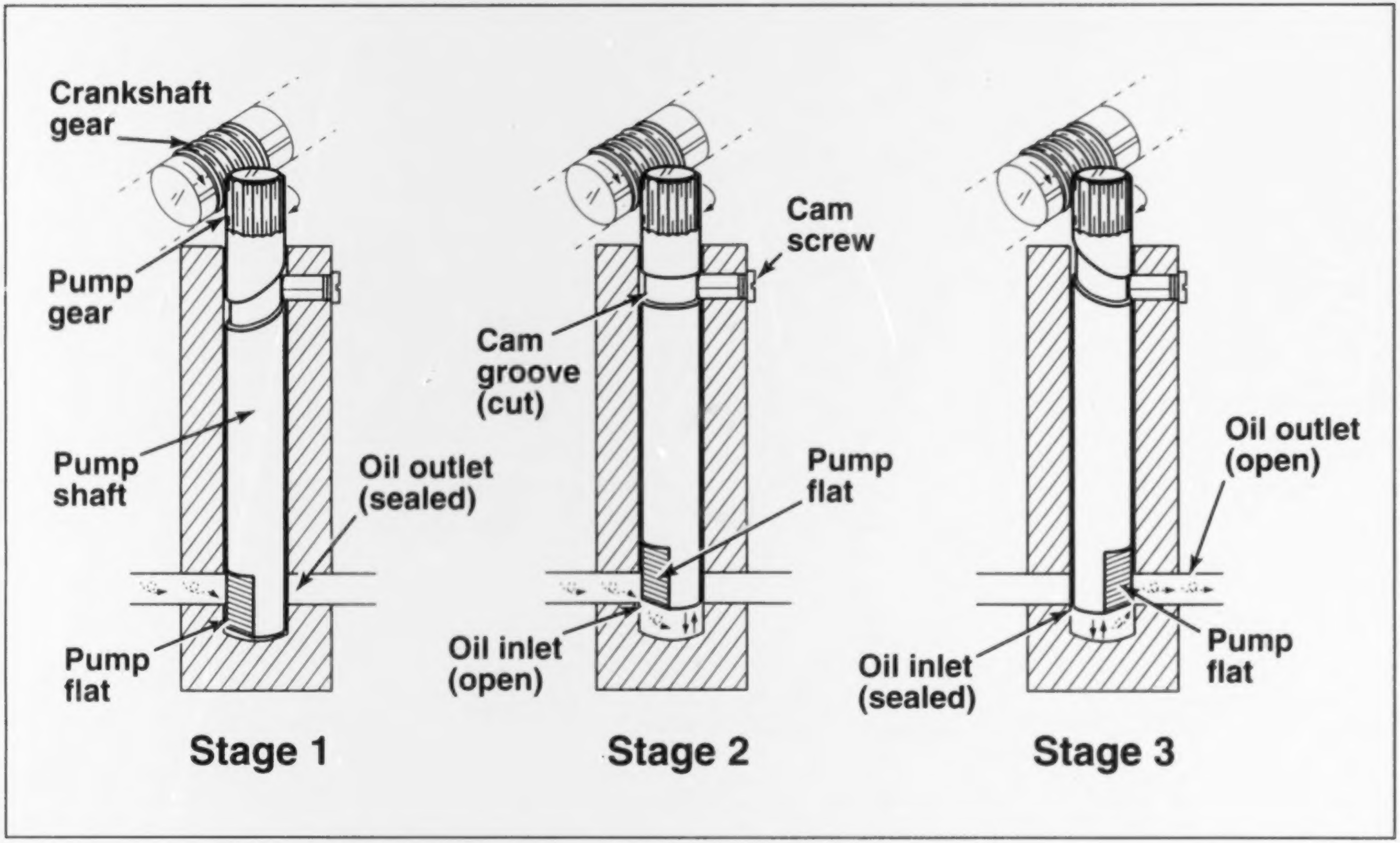

Oil pick-up hose
Metering chamber
Return port
Inlet port
Oil-flow control screw
Crankshaft cam
Outlet port
Pump piston
Plunger
Check ball
Bar

Lawn and Garden Equipment, Unit 4
Teacher Page 233

TM 10

Types of Chain Oilers:

Gear-Driven-Pump Chain Oiler

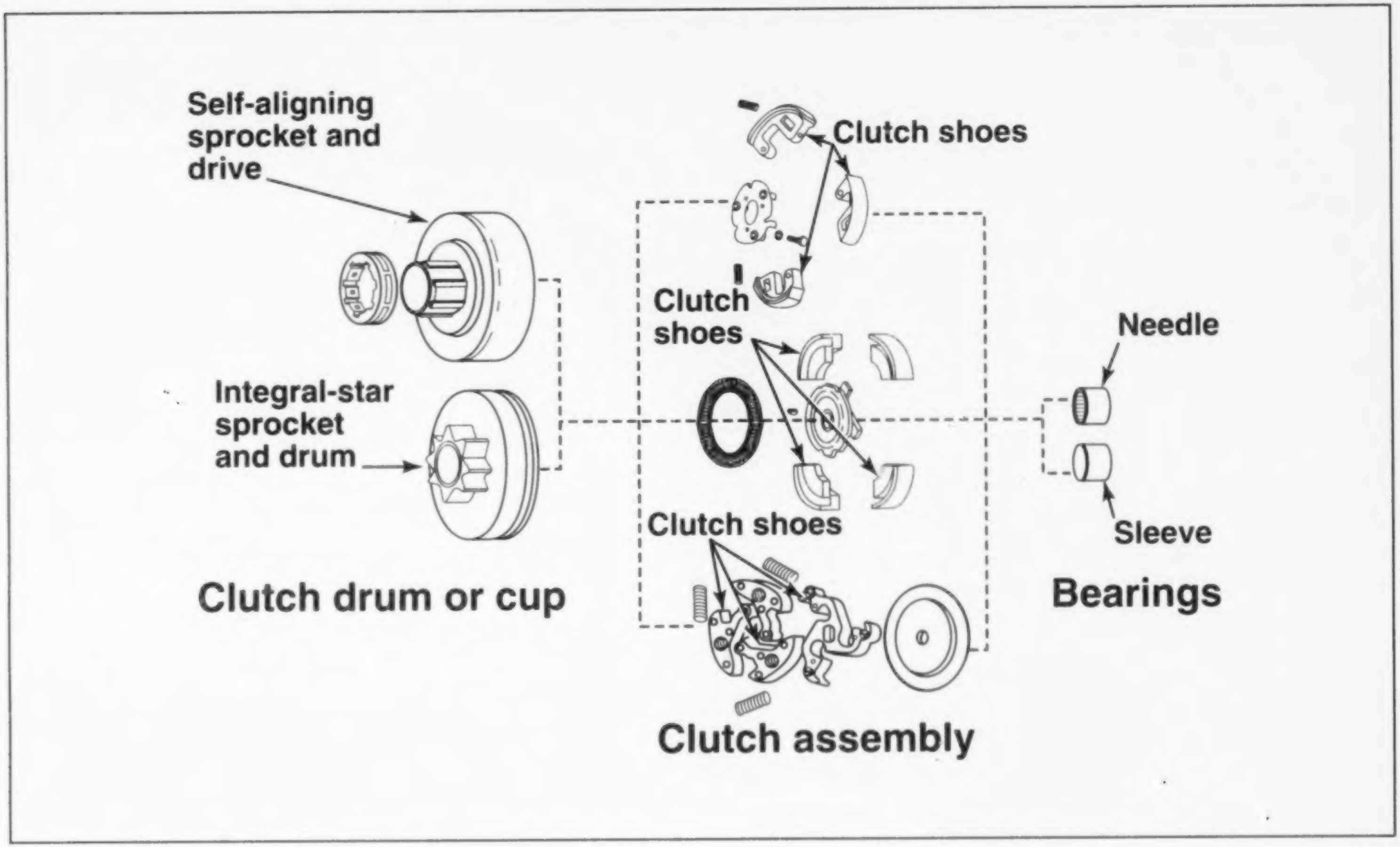

Crankshaft gear
Pump gear
Pump shaft
Oil outlet (sealed)
Pump flat
Stage 1
Cam screw
Cam groove (cut)
Pump flat
Oil inlet (open)
Stage 2
Oil outlet (open)
Oil inlet (sealed)
Pump flat
Stage 3

Lawn and Garden Equipment, Unit 4
Teacher Page 235

TM 11

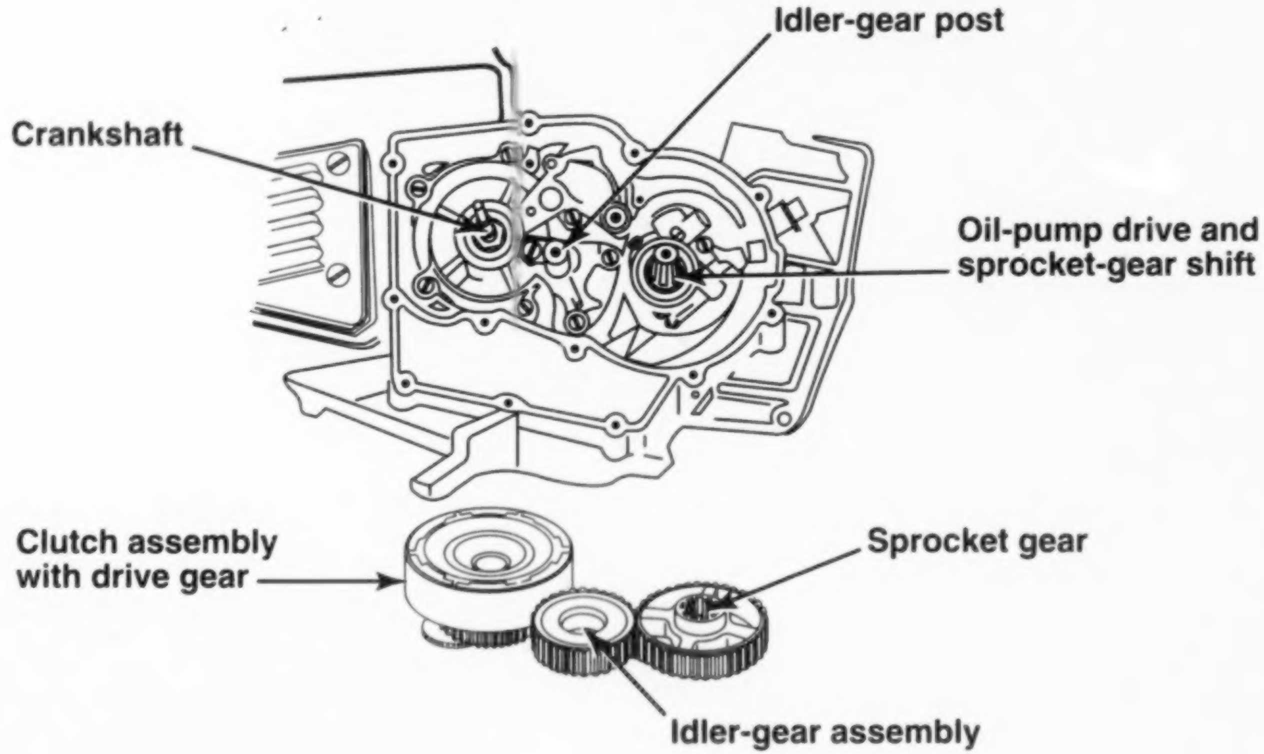
Types of Chain Drives:

Direct Chain Drive

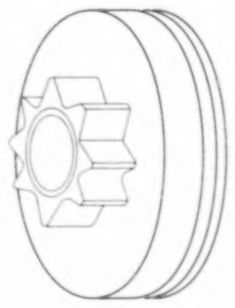

Self-aligning sprocket and drive
Integral-star sprocket and drum
Clutch drum or cup
Clutch shoes
Clutch shoes
Clutch shoes
Clutch assembly
Needle
Sleeve
Bearings

Types of Chain Drives:

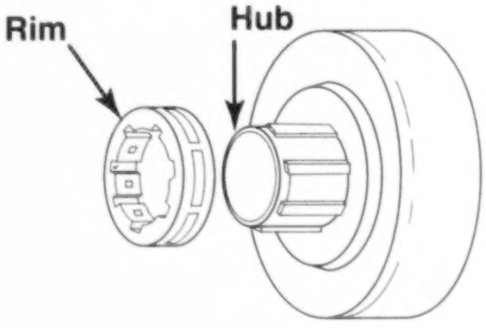
Gear-Reduction Chain Drive


Idler-gear post
Crankshaft
Oil-pump drive and sprocket-gear shift
Clutch assembly with drive gear
Sprocket gear
Idler-gear assembly

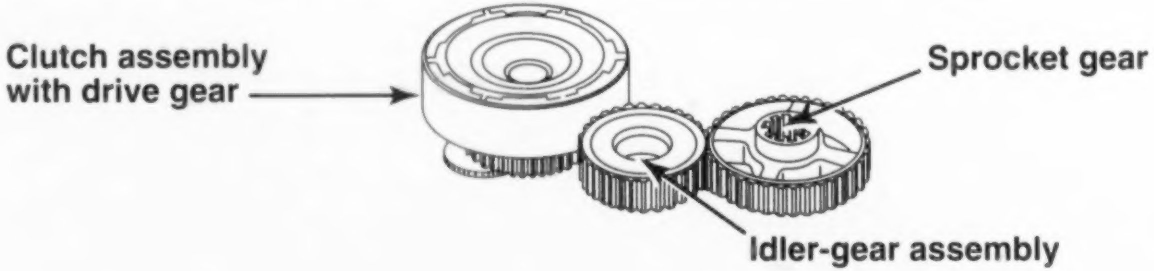
Types of Drive Sprockets



Integral-star sprocket



Self-aligning sprocket


Clutch assembly
with drive gear
Sprocket gear
Idler-gear assembly

Gear-drive sprocket

Job Sheet 1

Worksheet—Perform Routine Maintenance on Chain Saws

Name ______________________________ Attempt number __________

Date ______________________________

Part A: Pre-performance check

Job ______________________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________________

  Equipment model/type and code ______________________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________________

  Section/page number of procedure ______________________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________________

Worksheet—Perform Routine Maintenance on Chain Saws

Part B: **Performance evaluation**

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

____

____

Job Sheet 2

Worksheet—Repair Chain Saws

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 2

Worksheet—Repair Chain Saws

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

____

____

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Power Product Equipment Technician Series

Theory and Principles of Engine Operation
Section A: Orientation
Section B: Basic Engine Theory and Operation

Engine Systems and Service
Section A: Engine Systems
Section B: Engine Overhaul

Equipment Systems

Construction Equipment

Lawn and Garden Equipment

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Stillwater, OK 74074-4364
1-800-654-3988

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Lawn and Garden Equipment

YARD-MAN
YARD-MAN

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Student Edition

Power Product Equipment Technician:

Lawn and Garden Equipment

Student Edition

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Lawn and Garden Equipment

Student Edition

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Introduction to Lawn and Garden Equipment
Unit 1

Objective Sheet

Unit objective

After completing this unit, the student should be able to describe the functions of and determine service specifications and parts requirements for common types of light- and heavy-duty lawn and garden equipment. The student should demonstrate these competencies by completing the assignment sheets and by scoring a minimum of 85 percent on the written test.

Specific objectives

After completing this unit, the student should be able to

1. Define the term *lawn and garden equipment.*
2. Define the terms *light-duty equipment* and *heavy-duty equipment.*
3. State the functions of common types of light-duty lawn and garden equipment.
4. State the functions of common types of heavy-duty lawn and garden equipment.
5. List typical service procedures required for lawn and garden equipment.
6. Determine light-duty lawn and garden equipment service specifications and parts requirements. (Assignment Sheet 1)
7. Determine heavy-duty lawn and garden equipment service specifications and parts requirements. (Assignment Sheet 2)

Introduction to Lawn and Garden Equipment
Unit 1

Information Sheet

1. **Definition of the term *lawn and garden equipment***

   - **Lawn and garden equipment**—Power product equipment used to care for and maintain cultivated areas and the borders between cultivated areas and structures such as sidewalks, yards, drives, and patios

     Note: While the various types of power product equipment have many uses, the most popular products are those used by homeowners and yard-care professionals in maintaining cultivated areas (lawns, flower and vegetable gardens, and orchards) and the borders between cultivated areas and structures such as sidewalks, drives, and patios.

2. **Definitions of the terms *light-duty equipment* and *heavy-duty equipment***

   Note: This objective introduces you to definitions of the two major classifications of lawn and garden equipment—light-duty and heavy-duty equipment. Consider these as working definitions to help you begin to distinguish between the classifications of lawn and garden equipment, but remember, as you gain experience in servicing lawn and garden equipment, you will learn that the distinctions given here are somewhat arbitrary.

   - **Light-duty equipment**—Type of lawn and garden equipment that is intended for residential use, is either walked behind or carried by the operator, and is not capable of transporting the operator

   - **Heavy-duty equipment**—Type of lawn and garden equipment that is intended for agricultural, commercial, or industrial use and can either travel under its own power and transport the operator or must be carried by two or more people

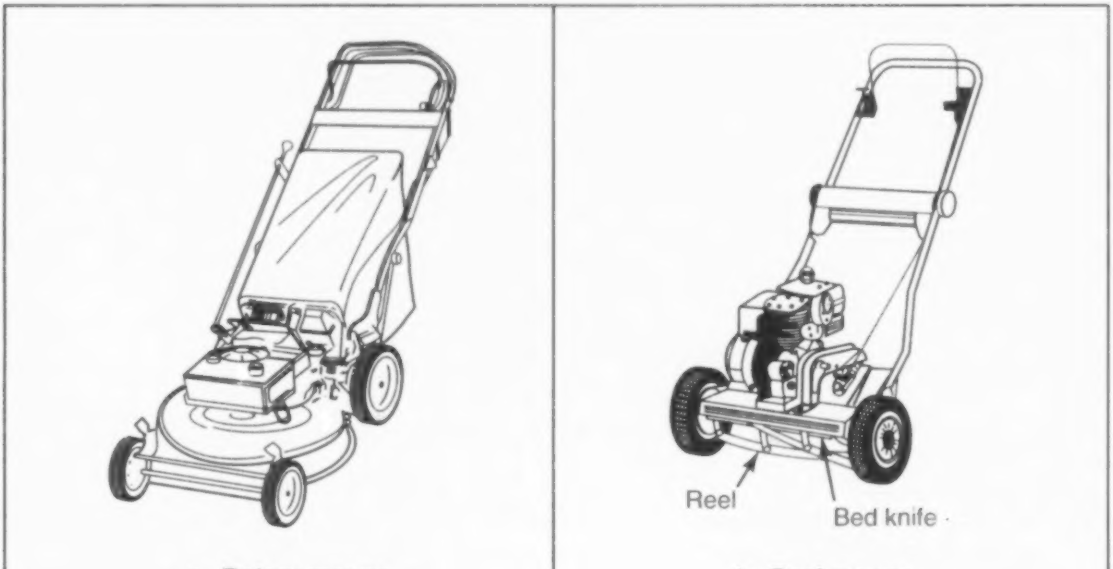
3. **Common types of light-duty lawn and garden equipment and their functions**

   - **Walk-behind lawn mower**—Used to cut grass to a specific height

     Note: The walk-behind lawn mower was one of the first pieces of power product equipment to gain popularity with the public. Three operating features are used to classify walk-behind lawn mowers: (1) type of blade—rotary or reel, (2) discharge path—side discharge or rear discharge, and (3) drive-power source—pushed or self-propelled. Rotary and reel mowers and side- and rear-discharge mowers are shown in Figure 1 on the next page.

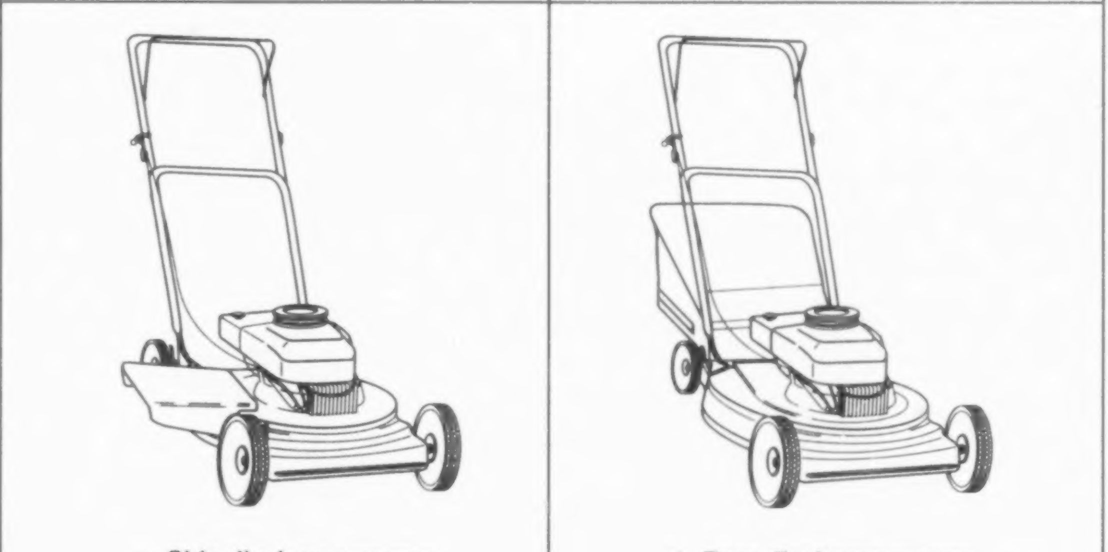
Information Sheet

Figure 1: Walk-behind lawn mowers


Reel
Bed knife

a. **Rotary mower**

b. **Reel mower**



c. **Side-discharge mower**

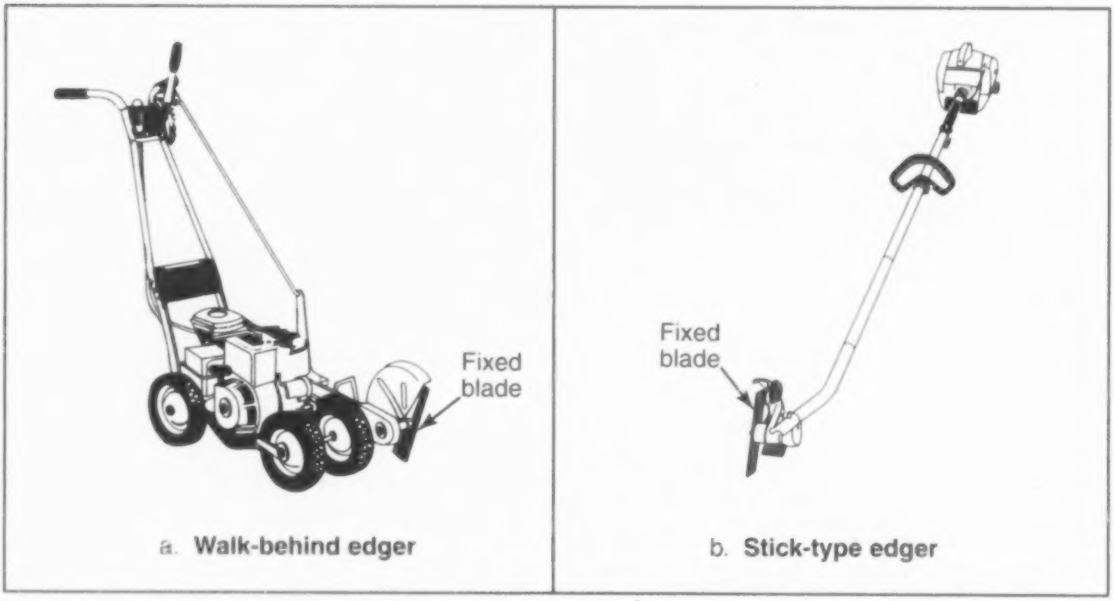
d. **Rear-discharge mower**

Information Sheet

- **Edger**—Used to cut grass along the edges of sidewalks, patios, and other surfaces that are relatively the same level as the base of the lawn

  Note: Generally, power edgers are either wheeled, walk-behind-type or carried, stick-type designs—both of which use a fixed blade to cut the grass (see Figure 2); however, some models (called *rotating-head edgers*) have a head that swivels to allow the equipment to make horizontal cuts and be used as a trimmer.

Figure 2: Edgers



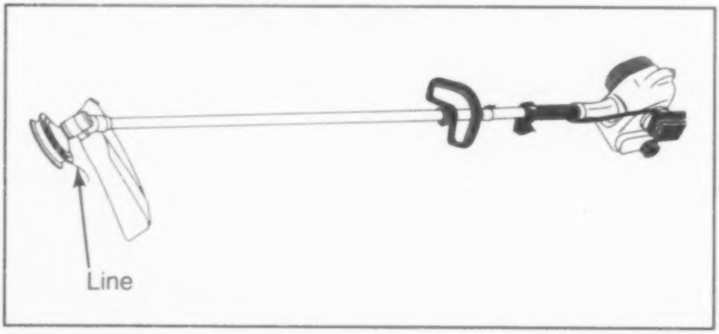
a. **Walk-behind edger**

b. **Stick-type edger**

- **Trimmer**—Used to cut grass and weeds along vertical surfaces such as building foundations and trees and on surfaces that are too rough or at angles that are too dangerous for lawn mowers

  Note: Generally, edgers make vertical cuts and power trimmers make horizontal cuts. Most trimmers use a metal or nylon blade or plastic line (see Figure 3) to make the horizontal cuts required to trim grass and weeds.

Figure 3: Trimmer

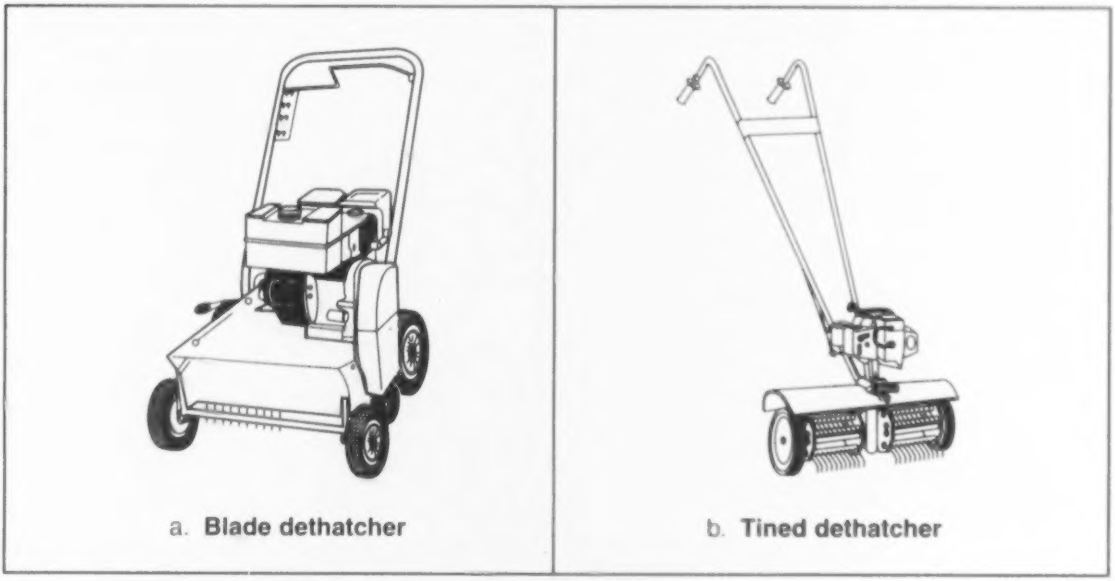


Information Sheet

- **Dethatcher**—Used to break up lawn thatch and to lift it from the base of the living grass

  Note: Thatch is dead grass that builds up at the base of living grass after a lawn has been mown. Dethatchers (see Figure 4) have blades or tines that cut vertically on a rotating shaft; the blades or tines slice through the thatch and lift it from the base of the living grass.

Figure 4: Dethatchers



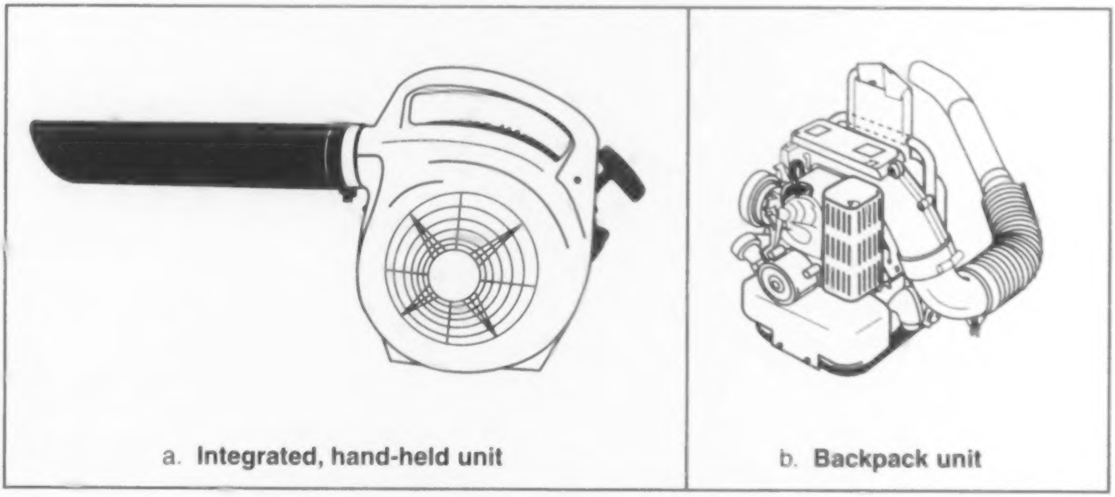
a. **Blade dethatcher**

b. **Tined dethatcher**

- **Blower**—Used to create a strong stream of forced air the operator uses in moving leaves, grass cuttings, and other light debris to a place where the debris can be collected

  Note: Blowers are usually either an integrated, hand-held unit (see Figure 5-a) or a backpack unit (see Figure 5-b).

  Figure 5: Blowers



a. **Integrated, hand-held unit**

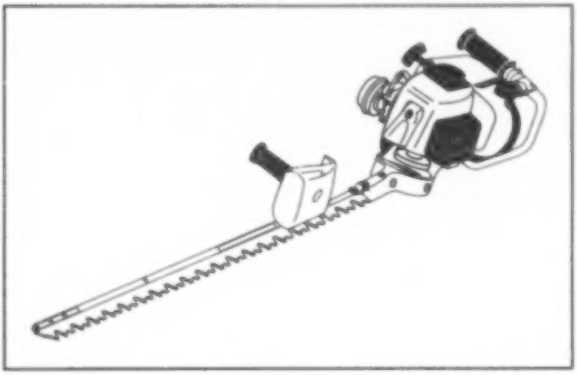
b. **Backpack unit**

Information Sheet

- **Hedge clippers**—Used to trim small branches from and to shape hedges, shrubs, bushes, and small trees

  Note: Hedge clippers (see Figure 6) use short reciprocating cutting motions to slice small branches from hedges, shrubs, bushes, and small trees.

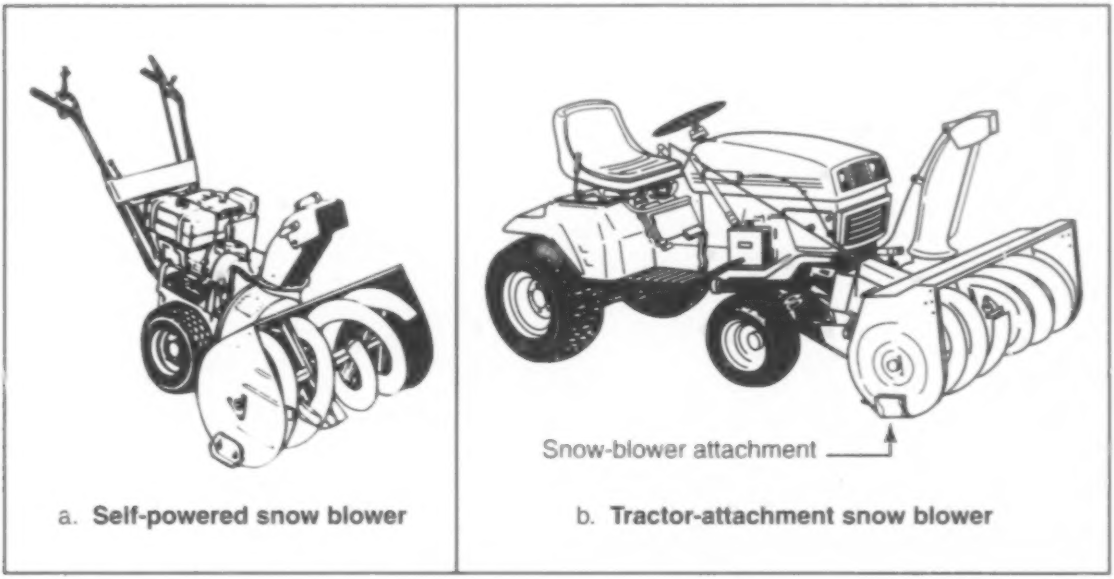
  Figure 6: Hedge clippers



- **Snow blower**—Used to remove snow from a surface and to throw the snow away from the removal area

  Note: Snow blowers come in a variety of sizes to handle varying depths of snow. They work by breaking up the snow in much the same way that a tiller breaks up soil. The two principle types of snow blowers are (1) those that are self-powered (see Figure 7-a) and (2) those that attach to garden tractors or similar power platforms and are driven by the power product equipment engine (see Figure 7-b).

Figure 7: Snow blowers



a. **Self-powered snow blower**

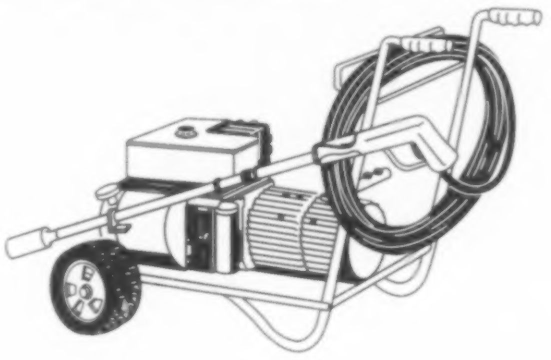
b. **Tractor-attachment snow blower**

Information Sheet

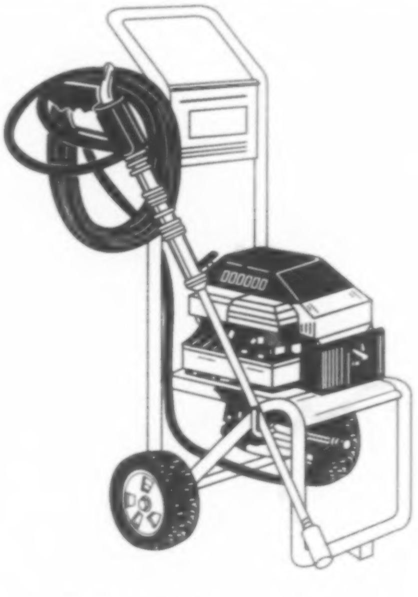
- **Pressure washer**—Used to provide a stream of water under pressure for washing cars, equipment, windows, and other items where the increased pressure will aid in removing dirt and grime or in reaching distant or hard-to-reach areas

  Note: Many cleaning tasks around the home and shop that require a stream of water would be easier if the stream were driven with more force than typically comes from normal tap pressure. For example, using a stream of water under high pressure to clean the grass, grime, and oil from a mower helps to work the material free from the equipment. Pressure washers (see Figure 8) provide that kind of force. Pressure washers use a variety of pump designs to increase water pressure, and the variations in pressure-washer designs occur with the differences in the types of pumps used.

Figure 8: Pressure washers



a. **Wheelbarrow-type pressure washer**



b. **Dolly-type pressure washer**

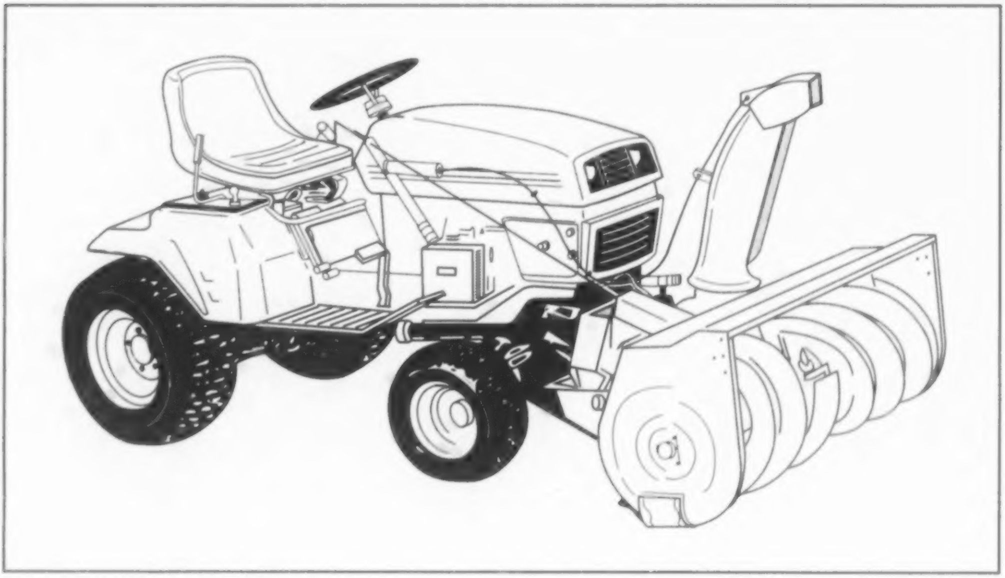
Information Sheet

4. Common types of heavy-duty lawn and garden equipment and their functions

- **Garden tractor**—Used as a self-propelled service platform for other equipment, such as mower decks, tillers, snow blowers, plows, lifts, and dirt blades

  Note: Garden tractors are service platforms designed to provide a self-propelled power source. Though almost always equipped with a mower deck, garden tractors can also be equipped with any of a number of other types of attachments, such as a hydraulic lift, a tiller, a snow blower (see Figure 9), or a push blade. Garden tractors accommodate these attachments on the front, rear, and underneath, and the tractors often have multiple equipment drives, which may be mechanical, hydraulic, or pneumatic.

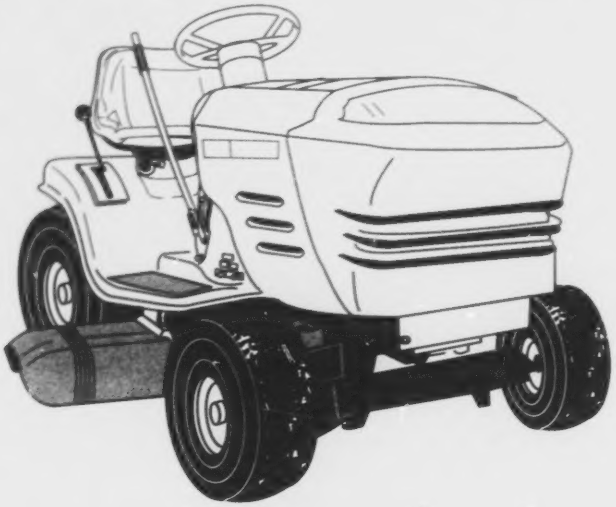
  Figure 9: Garden tractor



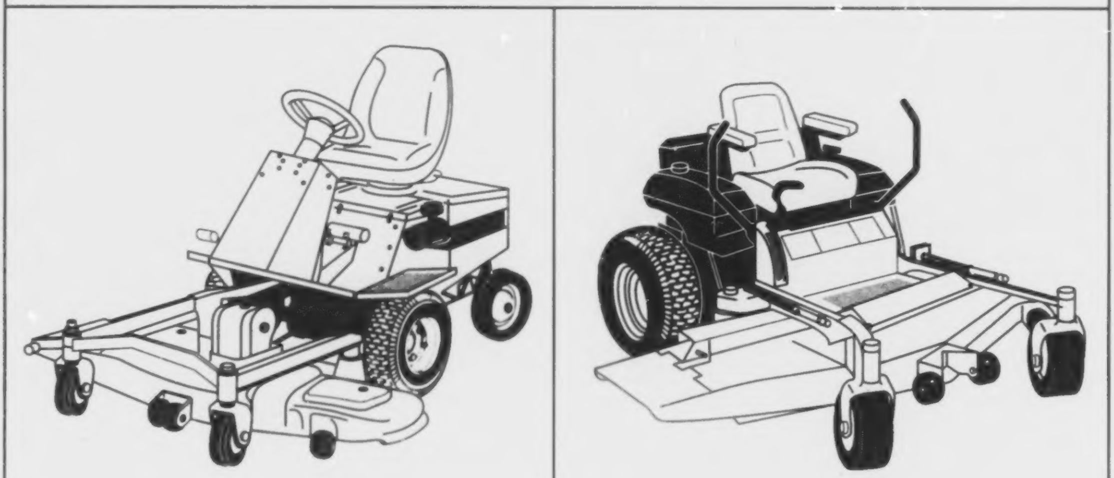
- **Riding lawn mower**—Used to cut grass while providing a place for the operator to sit and control the equipment

  Note: Riding lawn mowers (see Figure 10 on the next page) may look like garden tractors, but they differ from garden tractors in two ways. (1) Typically, riding lawn mowers are not as powerful as garden tractors; riding lawn mowers are powered by engines in the 8- to 20-horsepower range, while garden tractors are normally powered by engines in the 18- to 30-horsepower range. (2) Riding lawn mowers are not as versatile as garden tractors; riding lawn mowers are generally limited to mowing functions and usually do not have additional equipment drives.

Figure 10: Riding lawn mowers



a. **Front-engine riding lawn mower**



b. **Rear-engine riding lawn mower**

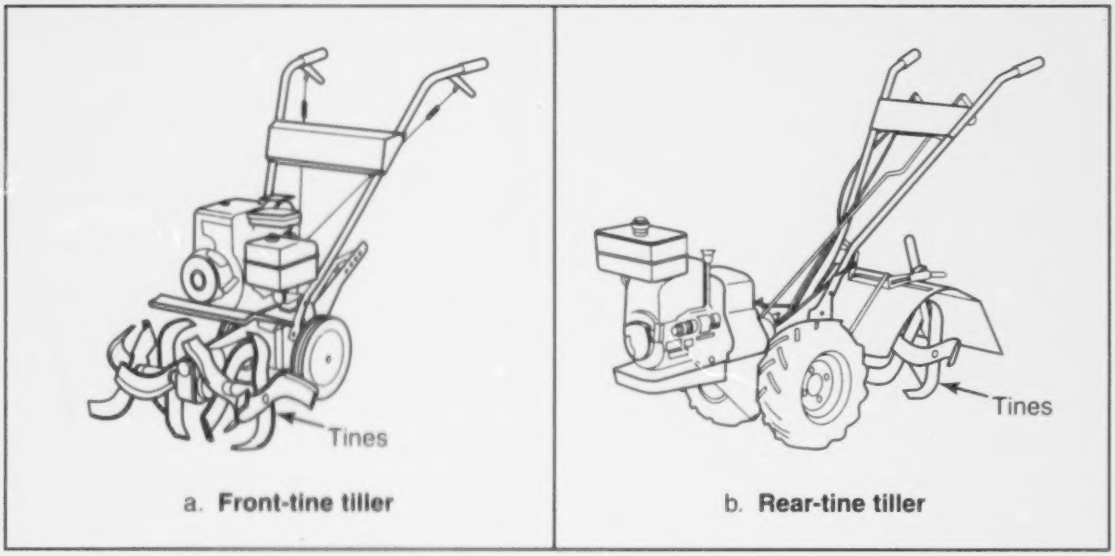
c. **ZTR (zero-turning-radius) riding lawn mower**

Information Sheet

- **Tiller**—Used to break up soil in gardens and flower beds

  Note: The tillers shown in Figure 11 are two of a family of tools designed to break up the soil so that certain other cultivation tasks can be performed in gardens and flower beds—planting seeds, working fertilizer into the soil, etc. The tiller shown in Figure 11-a is called a *front-tine tiller* because the cutting blades (tines) are in front of the wheels. Other tiller designs include *rear-tine tillers* (see Figure 11-b) and smaller tillers called *cultivators*. Cultivators look like edgers with multiple blades.

Figure 11: Tillers



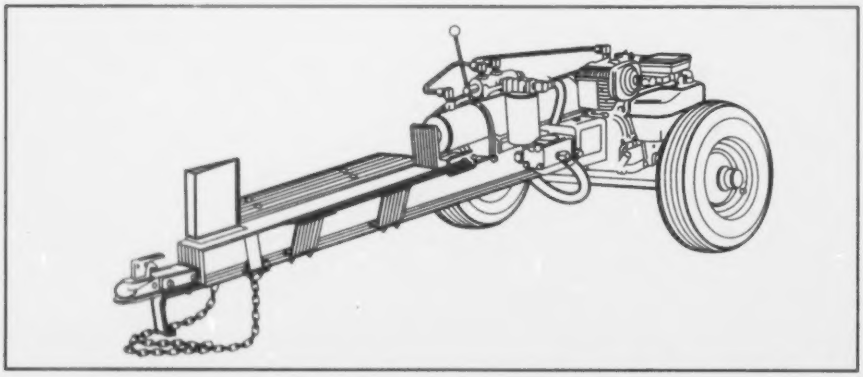
a. **Front-tine tiller**

b. **Rear-tine tiller**

- **Log splitter** (see Figure 12)—Used to break logs apart along their length

  Note: The growing popularity of wood-burning stoves and fireplaces has led to the increased use of certain types of power product equipment such as chain saws and log splitters. Log splitters use a hydraulic ram to drive a wedge into the end of a log and split it in two. Log splitters are frequently mounted on a wheeled frame like a trailer that supports the engine, a hydraulic system, and the ram track that guides the splitting wedge. Smaller designs are becoming popular.

Figure 12: Log splitter

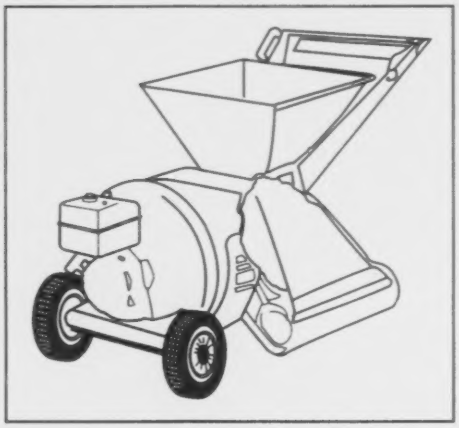


Information Sheet

- **Shredder**—Used to grind grass cuttings, leaves, branches, and limbs into small pieces that can be burned or used as mulch

  Note: Shredders (see Figure 13) vary greatly in size and engine horsepower to accommodate the different sizes of the materials they are used to grind, and as a result, the types of equipment within this family of tools have a variety of names. Small shredders intended for grinding leaves and grass cuttings are classified as light-duty equipment and are called *compost grinders*, larger shredders capable of chewing up fairly large limbs are known as *chippers*, and the largest shredders capable of grinding entire trees are called *commercial shredders*. Some shredders have attachments so that they can also function as lawn vacuums or blowers.

  Figure 13: Shredder



5. Typical service procedures required for lawn and garden equipment

Note: The remaining units in this book provide more information on the typical types of service procedures required for specific types of lawn and garden equipment.

- Service engine
- Service equipment drive
- Service drive train on self-propelled equipment
- Maintain blades and cutters

  Examples: Sharpen blades and cutters, balance blades and cutters
- Maintain filters and screens
- Lubricate moving parts
- Maintain control and adjustment features

  Examples: Clutches, brakes, pressure settings, blade clearances
- Perform adjustments to return equipment to original specifications
- Perform seasonal service

Introduction to Lawn and Garden Equipment
Unit 1

Assignment Sheet 1—Determine Light-Duty Lawn and Garden Equipment Service Specifications and Parts Requirements

Name ______________________________ Date ______________

Evaluation criteria	**Rating**
Directions have been followed.	______
Minimum of 80 percent of answers are correct.	______
Overall rating	______

Evaluator's comments ____

____

____

Introduction

A high percentage of the service work performed by power product equipment technicians involves lawn and garden equipment. While there is a growing demand for heavy-duty equipment, rotary lawn mowers and string trimmers represent the most common pieces of lawn and garden equipment. Thus, a service technician must be skilled in determining the parts and specifications required to support service for these items and other light-duty equipment. In this assignment sheet, you will practice selecting parts and determining specifications for the types of light-duty lawn and garden equipment that you are likely to service in your career as a power product technician.

Exercise

Directions

Your instructor will assign specific pieces of equipment for which you will determine specifications and part numbers. Using the resources available in your facility, determine the part numbers and specifications requested. Write your answers on the blank lines provided with each question.

Assignment Sheet 1

1. Your instructor will list five rotary lawn mowers on the blanks under the "Make/model" column in the table below. Determine the recommended spark plug and gap for these rotary lawn mowers.

	Make/model	Blade	Plug	Gap
a.		20"		
b.		22"		
c.		20"		
d.		22"		
e.		21"		

2. Ryobi manufactures a power trimmer that accepts attachments that allow it to perform other functions. Typically, one such model is a 15-inch, 31-cubic-centimeter unit, Model #725. What is the part number (or model number) for each of the attachments?

	Attachment	Part/model number
a.	Lawn edger	
b.	Tree pruner	
c.	Cultivator	

3. Your instructor will list three power blowers on the blanks under the "Make/model" column in the table below. Determine the part number for the impeller for each of these models of power blower.

	Make/model	Part number
a.		
b.		
c.		

Assignment Sheet 1

4. In the "Make/model" column in the table below, your instructor will list a make and model for each of the five types of equipment in the "Equipment" column. Determine the recommended idle-rpm setting for each of these types of equipment.

	Equipment	Make/model	HP	rpm
a.	Hedge clippers			
b.	Dethatcher			
c.	Mower			
d.	Edger			
e.	Trimmer			

5. In the "Make/model" column in the table below, your instructor will list a make and model for each of the five types of equipment in the "Equipment" column. Determine the recommended oil viscosity and capacity for each of these pieces of equipment.

	Equipment	Make/model	Oil viscosity	Capacity (in ounces)
a.	Blower			
b.	Dethatcher			
c.	Mower			
d.	Edger			
e.	Trimmer			

Assignment Sheet 1

6. Your instructor will list five pressure washers on the blanks under the "Make/model" column in the table below. Determine the rated pressure (psi) and flow (gpm) for these pressure washers.

	Make/model	Pressure	Flow
a.			
b.			
c.			
d.			
e.			

Introduction to Lawn and Garden Equipment
Unit 1

Assignment Sheet 2—Determine Heavy-Duty Lawn and Garden Equipment Service Specifications and Parts Requirements

Name ______________________ Date ____________

Evaluation criteria	**Rating**
Directions have been followed.	______
Minimum of 80 percent of answers are correct.	______
Overall rating	______

Evaluator's comments ______________________________

____

____

Introduction Heavy-duty lawn and garden equipment continue to grow in popularity. Sales for riding lawn mowers and garden tractors are booming, and equipment such as tillers and log splitters are becoming more common in household uses. This type of equipment accounts for a growing portion of service work. Furthermore, heavy-duty equipment manufacturers continue to offer more and more sophisticated features on their equipment. Electric starters, instrument gauges, lighting, shift-on-the-go transmissions, hydraulic brakes, PTOs, and other systems that make the equipment more versatile and easier for operators to use also mean additional service procedures, which are often more complicated than those for minimally equipped models. Therefore, service technicians must maintain their expertise in the technological developments that are taking place. This assignment sheet will provide you with practice in determining the features available on and specifications required for specific models of heavy-duty lawn and garden equipment.

Exercise

Directions Your instructor will assign specific pieces of equipment for which you will determine specifications and part numbers. Using the resources available in your facility, determine the part numbers and specifications requested. Write your answers on the blank lines provided with each question.

Assignment Sheet 2

1. Your instructor will list five riding lawn mowers on the blanks under the "Make/model" column in the table below. Determine the size of belt required for each of these riding-mower applications.

	Make/model	Application	Belt size
a.	______________________	Mower drive	__________
b.	______________________	Transmission	__________
c.	______________________	Cross drive	__________
d.	______________________	Reverse	__________
e.	______________________	Transmission	__________

2. Your instructor will list five garden tractors on the blanks under the "Make/model" column and the horsepower of each tractor in the "Horsepower" column in the table below. Determine the engine-oil capacity for each of these garden tractors.

	Make/model	Horsepower	Oil capacity
a.	______________________	_____ HP	__________
b.	______________________	_____ HP	__________
c.	______________________	_____ HP	__________
d.	______________________	_____ HP	__________
e.	______________________	_____ HP	__________

3. Your instructor will list five tillers on the blanks under the "Make/model" column in the table below. Determine the part number (or dimensions) of the chain for each of these tillers.

	Make/model	Chain part number/dimensions
a.	____________________	______________________
b.	____________________	______________________
c.	____________________	______________________
d.	____________________	______________________
e.	____________________	______________________

Light-Duty Lawn and Garden Equipment
Unit 2

Objective Sheet

Unit objective

After completing this unit, the student should be able to describe principles of operation of common types of light-duty lawn and garden equipment and perform routine maintenance and service procedures on such equipment. The student should demonstrate these competencies by completing the job sheets and by scoring a minimum of 85 percent on the written test.

Specific objectives

After completing this unit, the student should be able to

1. State safety rules for servicing light-duty lawn and garden equipment.
2. State the functions of the major components of walk-behind lawn mowers.
3. List operating features used to classify walk-behind lawn mowers.
4. Complete statements about the principles of operation of self-propelled rotary walk-behind lawn mowers.
5. Complete statements about the principles of operation of self-propelled reel walk-behind lawn mowers.
6. List typical service procedures required for walk-behind lawn mowers.
7. State the functions of the major components of edgers.
8. State the operating features used to classify edgers.
9. Complete statements about the principles of operation of edgers.
10. List typical service procedures required for edgers.
11. State the functions of the major components of trimmers.
12. State the operating feature used to classify trimmers.
13. Complete statements about the principles of operation of trimmers.
14. List typical service procedures required for trimmers.
15. State the functions of the major components of dethatchers.
16. List the operating features used to classify dethatchers.
17. Complete statements about the principles of operation of dethatchers.
18. List typical service procedures required for dethatchers.

Objective Sheet

19. State the functions of the major components of blowers.
20. List the operating feature used to classify blowers.
21. Complete statements about the principles of operation of blowers.
22. List typical service procedures required for blowers.
23. State the functions of the major components of hedge clippers.
24. List operating features used to classify hedge clippers.
25. Complete statements about the principles of operation of hedge clippers.
26. List typical service procedures required for hedge clippers.
27. State the functions of the major components of snow blowers.
28. Match types of snow blowers to their correct descriptions.
29. Complete statements about the principles of operation of snow blowers.
30. List typical service procedures required for snow blowers.
31. State the functions of the major components of pressure washers.
32. State the operating feature used to classify pressure washers.
33. Complete statements about the principles of operation of pressure washers.
34. List typical service procedures required for pressure washers.
35. Perform routine maintenance on lawn mowers. (Job Sheet 1)
36. Repair lawn mowers. (Job Sheet 2)
37. Perform routine maintenance on edgers. (Job Sheet 3)
38. Repair edgers. (Job Sheet 4)
39. Perform routine maintenance on trimmers. (Job Sheet 5)
40. Repair trimmers. (Job Sheet 6)
41. Perform routine maintenance on dethatchers. (Job Sheet 7)
42. Repair dethatchers. (Job Sheet 8)
43. Perform routine maintenance on blowers. (Job Sheet 9)
44. Repair blowers. (Job Sheet 10)
45. Perform routine maintenance on hedge clippers. (Job Sheet 11)

Objective Sheet

46. Repair hedge clippers. (Job Sheet 12)
47. Perform routine maintenance on snow blowers. (Job Sheet 13)
48. Repair snow blowers. (Job Sheet 14)
49. Perform routine maintenance on pressure washers. (Job Sheet 15)
50. Repair pressure washers. (Job Sheet 16)

Light-Duty Lawn and Garden Equipment
Unit 2

Information Sheet

1. **Safety rules for servicing light-duty lawn and garden equipment**

- **Remove the spark plug when performing service that does not require the engine to be running.**

  Examples of service that does not require the engine to be running: Changing the line on trimmers; removing material from mower blades

  Note: Most of all the types of light-duty equipment discussed in this unit have moving parts that can cut or crush body parts. To ensure that the engine cannot start and the moving parts cannot cause injury when performing service, the technician should remove the source of iginition. The best way to do this is to remove the spark plug. Some manufacturer's procedures recommend disconnecting the spark-plug lead and making sure that it cannot contact the spark plug. Follow the manufacturer's grounding recommendations.

- **Do not expose spilled fuel to heat or sparks from the hot equipment.**

  Note: Technicians tend to forget about fuel safety when they are not working on the fuel system. When equipment systems require service, technicians forget the equipment must be moved around a lot, increasing the likelihood of fuel spills, which increases the likelihood that the fuel will be exposed to heat and sparks from the hot equipment.

- **Allow the equipment to cool for at least 10 minutes before filling the fuel tank, and move the equipment at least 10 feet from the site of refueling.**

- **Do not operate equipment when the guards, shields, or other safety features have been removed.**

  Note: To perform service procedures on equipment systems, the technician must often remove guards, shields, or other safety features, which may tempt him or her to take shortcuts and test the equipment without reinstalling these safety features. But, you should never operate equipment unless the safety features have been properly reinstalled.

- **Do not operate equipment that is under an excessive load.**

  Examples: A mower with its blade in a bind; a blower with a clogged discharge port

  Note: Prior to starting, always check equipment to make sure there is no interference with the drive train that would create an excessive load. Operating equipment under an excessive load can cause engine damage or other equipment damage.

- **Never direct operating equipment so that forced air or debris discharge could reach another person.**

  Examples: Debris discharged from mowers, forced air from blowers

  Note: Forced air and debris carried by forced air discharged from power product equipment can be carried great distances. Numerous injuries occur each year as a result of objects being thrown at people from someone operating power product equipment nearby.

Information Sheet

2. **Major components of walk-behind lawn mowers and their functions** (see Figure 1-a on page 26)

   - **Handlebar**—Allows the operator to push and turn the mower and may support various controls

     Note: In addition to providing a means of guiding the mower, the handlebar often provides access to various controls, including the throttle control and the blade-brake lever. Additionally, the handlebar may hold starter controls (either a switch for an electric starter or a pull rope for a recoil starter) or transmission controls for self-propelled models.

   - **Throttle control**—Allows the operator to control engine speed

   - **Blade-brake lever**—Prevents the engine from running when the component is not engaged

     Note: Since 1982 under federal legislation, walk-behind mowers must be equipped with a system that ensures that the blade stops turning if the operator releases the mower. Typically, this is done with a cable system that if released shuts off the ignition spark to the engine, which stops the blade. The system is engaged by the operator's holding a spring-loaded lever against the handlebar so that his or her releasing the lever automatically shuts off the engine and activates the flywheel or blade brake.

   - **Engine**—Provides rotary power to the blade and, in some designs, to the drive wheels

   - **Deck**—Supports the engine

     Note: The mower deck is one of the most overlooked components of a walk-behind mower. It supports the engine and related systems and provides reinforced attachments for the tire and wheel assemblies and the handlebar. The mower deck is shaped to create an air chamber around the blade. Air moving within this chamber as a result of the rotation of the blade lifts the grass cuttings and funnels air to the discharge chute. Mower decks are often equipped with other safety features, such as drag shields at the rear of the mower to prevent objects from being thrown back at the operator and to keep the operator's toes out from under the mower. The deck should be kept clean (on both the outside surface and the underneath surface), free of rust, and in good repair.

   - **Blade**—Cuts the grass and produces the forced air necessary to discharge the grass cuttings

     Note: To operate properly, a blade must be balanced, sharp, and rotating at an adequate, safe speed. Blades can become imbalanced due to being bent or nicked from striking objects or from being unevenly worn. Cutting efficiency is largely a matter of blade sharpness and speed. While a mower blade need not have an edge like a knife, it must be capable of cutting grass at a safe speed.

   - **Discharge chute**—Directs the airflow that discharges the grass cuttings

     Note: Because of the danger of objects being thrown from them, discharge chutes are often equipped with protective devices such as metal bars and flexible flaps. A metal bar is often installed across the chute opening at a height that will deflect an operator's foot away from the blade, and a flap is often installed over the chute opening to deflect objects discharged from the mower away from the operator.

Information Sheet

- **Tire and wheel assemblies**—Support the engine and the deck and allow the mower to move over surfaces to be mowed

  Note: Many types of tire and wheel assemblies are used on walk-behind mowers. While most walk-behind mowers have solid-rubber tires on solid-plastic or metal rims, some models use large spoke wheels for the rear assemblies. Tire and wheel assemblies are also likely to vary for self-propelled models, as many of these models use a cog tire to mate with the drive mechanism.

3. Operating features used to classify walk-behind lawn mowers

Note: While there are many differences in the engines, starting systems, and other design features of walk-behind mowers, three major operating features are used to classify these mowers: (1) the type of blade used, (2) the path used for discharging the grass cuttings, and (3) whether the power from the engine is used to drive the mower or whether the operator supplies that power by pushing the machine.

- **Type of blade—rotary or reel**

  Note: The blades of lawn mowers with rotary blades (see Figure 1-a on the next page) rotate with an axis of rotation that is perpendicular to the ground. Rotary blades typically range from 18 to 22 inches in length and have a tapered cutting edge along the last 3 to 4 inches of the leading edge of each end of the blade. Maximum speeds range from 2800 to 3200 revolutions per minute, with lower speeds for long blades and higher speeds for short blades. Speeds above that range are not generally safe because of the high rate of speed at the tip. These rates can hurl a struck object with the force of a bullet.

  The blades of lawn mowers with reel blades rotate with an axis of rotation that is parallel to the ground. The cutting mechanism of lawn mowers with reel blades (see Figure 1-b on the next page) consists of two parts. The reel is the part rotated by the engine. The reel grabs grass as the mower moves forward and pushes the grass against the bed knife. The bed knife is sharpened and provides the cutting edge. The continued rotation of the reel pushes the grass cuttings past the bed knife and discharges them.

- **Discharge path—side discharge or rear discharge**

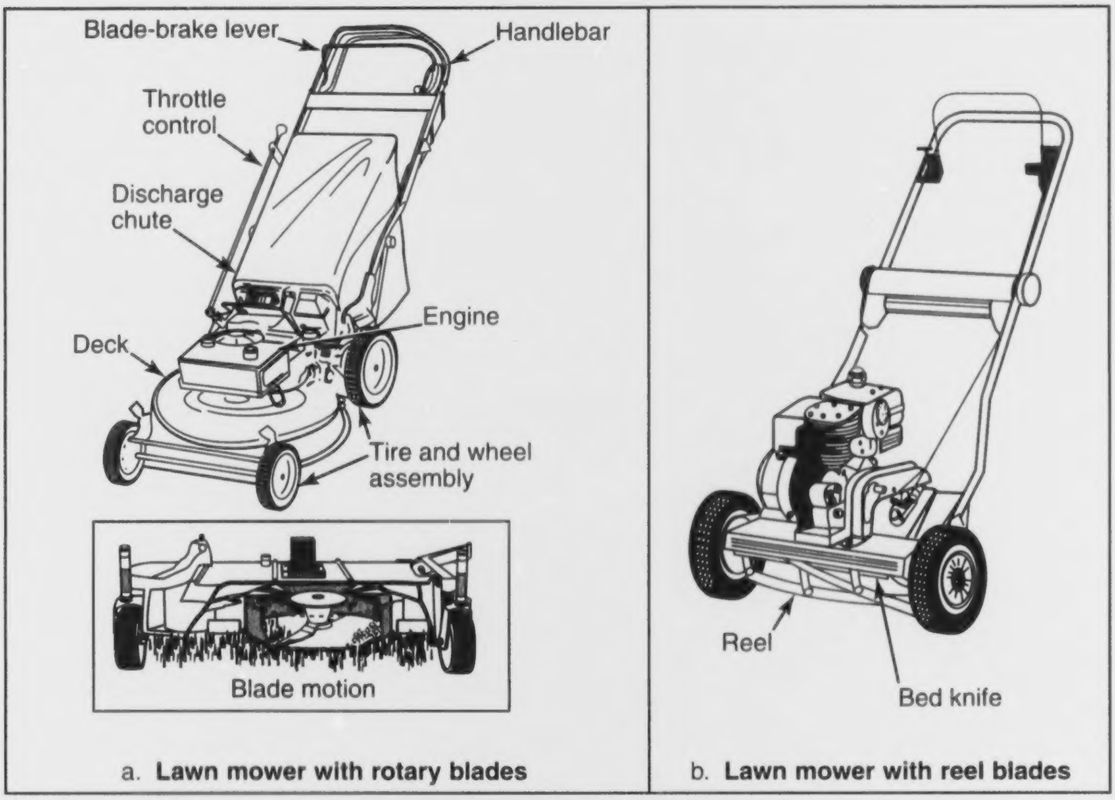
  Note: As you learned in Objective 2, walk-behind lawn mowers have a discharge chute that directs the airflow that discharges the grass cuttings from the mower. Most rotary mowers have a side-discharge-chute configuration (see Figure 2-a on the next page), though some rotary mowers have a rear-discharge-chute configuration that is designed to discharge the grass cuttings into a bag hung at the back of the mower (see Figure 1-a and Figure 2-b on the next page). Some rotary mowers provide a mulching function, which may not use a discharge chute at all. Most reel mowers use a rear-discharge-chute configuration.

- **Drive-power source—pushed or self-propelled**

  Note: Some walk-behind lawn mowers have drive trains to turn one or more wheels, generally the rear wheels. The most common designs use either chains to drive the rear axle or a gear that meshes with one of the rear wheels. These drive trains may be single-speed or multiple-speed; they usually do not have reverse gears.

Information Sheet

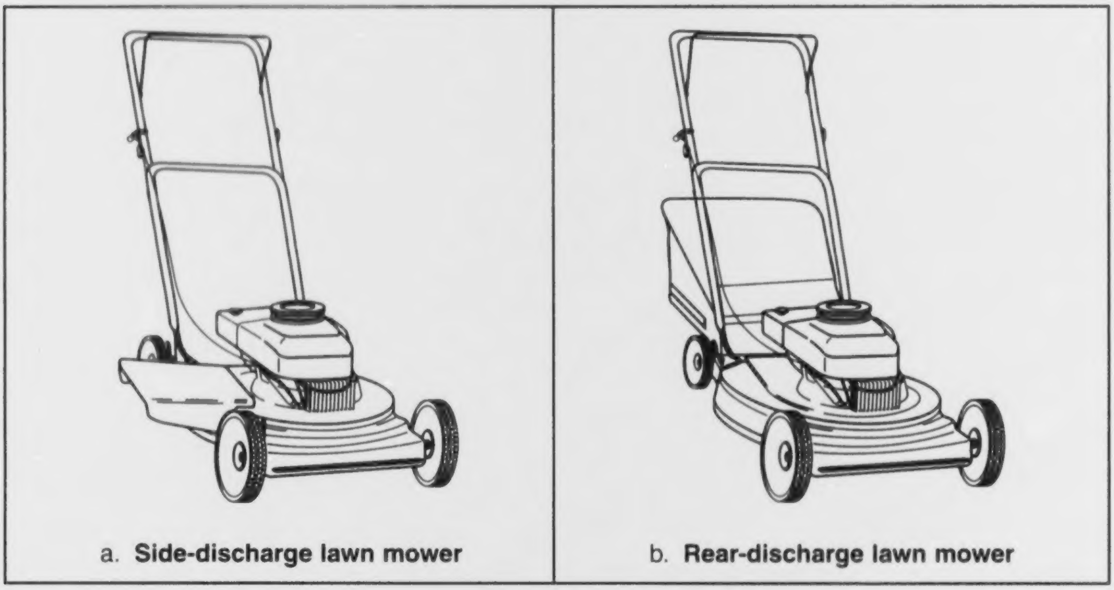
Figure 1: Types of mowers based on blade motion


Blade-brake lever
Handlebar
Throttle control
Discharge chute
Engine
Deck
Tire and wheel assembly
Blade motion
Reel
Bed knife

a. **Lawn mower with rotary blades**

b. **Lawn mower with reel blades**

Figure 2: Types of mowers based on discharge paths



a. **Side-discharge lawn mower**

b. **Rear-discharge lawn mower**

Information Sheet

4. Principles of operation of self-propelled rotary walk-behind lawn mowers

- Power from the engine causes the blade to rotate with an axis of rotation that is perpendicular to the ground; the rotation of the blade cuts the grass and causes air to circulate under the mower deck; the circulating air carries the grass cuttings until they are discharged at the discharge chute.

- Power from the engine is tranferred to a drive axle, usually by a chain or a belt, or in some designs, by a friction wheel.

- The operator controls the movement of the mower by using the handlebar.

5. Principles of operation of self-propelled reel walk-behind lawn mowers

- Power from the engine causes the blade to rotate with an axis of rotation that is parallel to the ground; the rotation of the blade causes air to circulate and pulls the grass into the bed knife, which cuts the grass; the circulating air carries the grass cuttings past the bed knife until they are discharged at the rear of the mower.

- Power from the engine is transferred to a drive axle, usually by a friction wheel or geared wheel, or in some designs, by a chain or a belt.

- The operator controls the movement of the mower by using the handlebar.

6. Typical service procedures required for walk-behind lawn mowers

- Sharpen blade or bed knife
- Balance blade
- Maintain oil level
- Change oil
- Clean filter
- Replace filter
- Maintain spark plug
- Service ignition system
- Service fuel system
- Lubricate wheels and chassis components
- Inspect and service safety systems
- Service starter system
- Adjust mower height
- Service self-propelled system, if mower is so equipped

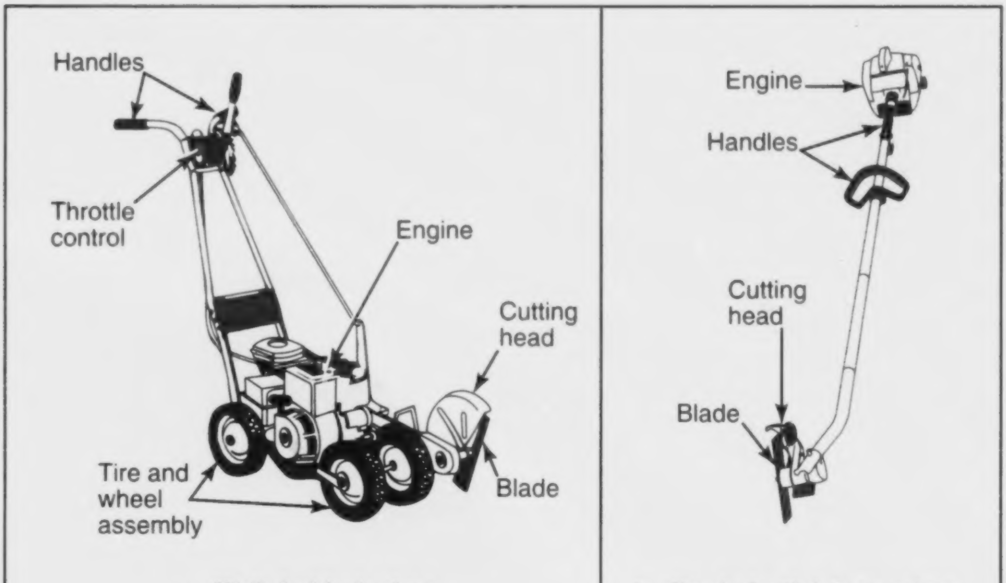
Information Sheet

7. **Major components of edgers and their functions** (see Figure 3)

Note: Two types of operating configurations are used for power edgers—the walk-behind configuration (see Figure 3-a) and the carried, stick-type configuration (see Figure 3-b). Besides the components common to both walk-behind and stick-type edgers, walk-behind edgers also have tire and wheel assemblies that allow them to be pushed by an operator.

- **Handles**—Allow the operator to guide the edger and may support various controls
- **Throttle control**—Controls the throttle setting, which controls the engine speed
- **Engine**—Provides the rotary power to power the blade
- **Cutting head**—Supports the blade
- **Blade**—Cuts the grass
- **Tire and wheel assemblies**—Support the engine on walk-behind edgers and allow an edger to be moved over the surfaces to be edged

Figure 3: Edgers


Handles
Throttle control
Engine
Cutting head
Tire and wheel assembly
Blade
Engine
Handles
Cutting head
Blade

a. **Walk-behind edger**

b. **Carried, stick-type edger**

8. **Operating features used to classify edgers**

- **Operating configuration—walk-behind design or carried, stick-type design**

- **Cutting-head design—fixed head or rotating head**

  Note: Fixed-head edgers are designed so that the blade is at an axis of rotation that is parallel to the ground and, therefore, makes a vertical cut to provide a clean lawn edge along sidewalks, curbs, and other surfaces. With rotating-head edgers, the blade can be set so that the axis of rotation is either parallel or perpendicular to the ground. When set so that the axis of rotation is perpendicular to the ground, the edger can function as a trimmer. A lever or other actuating device is used to swivel the head on models with that feature, though a fastener or similar device may have to be unlocked to allow the head to swivel.

9. **Principles of operation of edgers**

- Power from the engine causes the blade to rotate; the blade cuts the grass, which falls outside the cutting head.

- The operator controls the movement of the edger by using the handles.

10. **Typical service procedures required for edgers**

- Sharpen blade
- Balance blade
- Maintain oil level
- Change oil
- Clean filter
- Replace filter
- Maintain spark plug
- Service ignition system
- Service fuel system
- Lubricate wheels and chassis components on walk-behind models
- Inspect and service safety systems
- Service starter system

11. **Major components of trimmers and their functions** (see Figure 4 on the next page)

- **Handles**—Allow the operator to guide the trimmer and may contain some trimmer controls

- **Throttle control**—Controls the throttle setting, which controls engine speed

  Note: Many different throttle-control configurations are used on trimmers.

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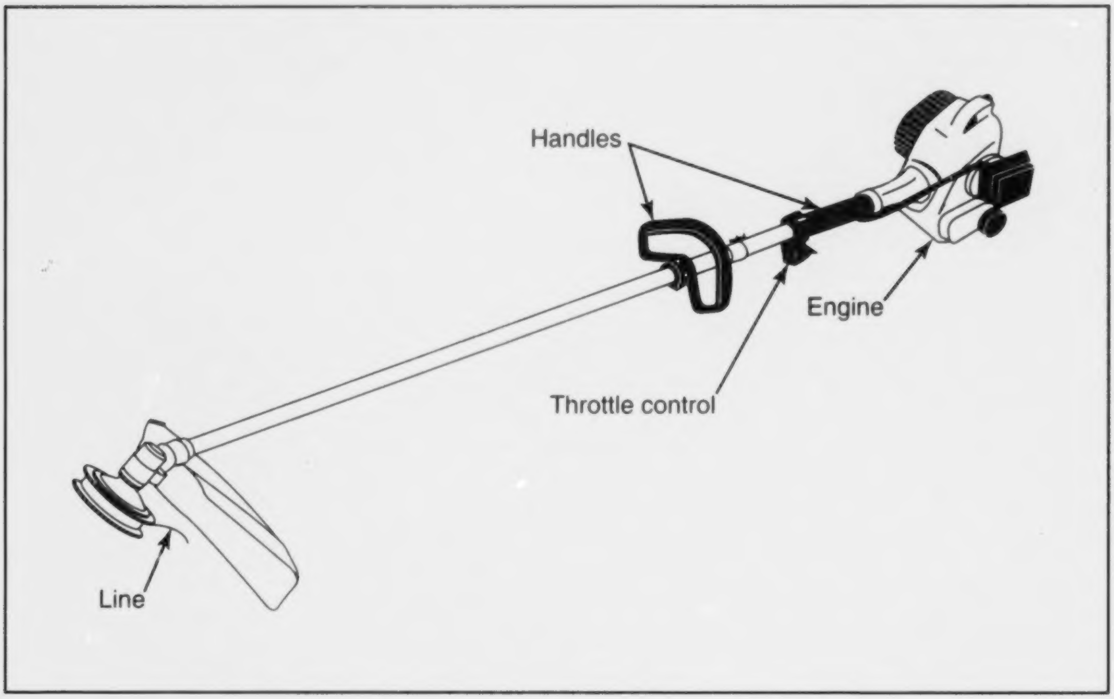
- **Engine**—Provides the rotary power to power the blade or line

  Note: Many trimmers use monofilament line as the cutting mechanism to cut grass and other vegetation. In trimmers that use line, the plastic line is mounted in a spool, and the trimmers have controls for automatically or manually advancing new line when the line becomes too worn or broken to cut properly. Other trimmers use a metal or nylon blade as the cutting mechanism.

- **Line or blade**—Cuts the grass or vegetation

Figure 4: Trimmer



12. **Operating feature used to classify trimmers**

- **Cutting mechanism—line or blade**

13. **Principles of operation of trimmers**

- The engine provides rotary power that drives a shaft to which the cutting mechanism—a blade or spool and monofilament line—is attached; the rotation of the cutting mechanism cuts the grass and vegetation at the height chosen by the operator.
- The operator controls the movement of the trimmer by using the handles to guide the trimmer back and forth over the surface to be trimmed.

Information Sheet

14. Typical service procedures required for trimmers

- Sharpen blade
- Balance blade
- Replace line
- Maintain oil level
- Change oil
- Clean filter
- Replace filter
- Maintain spark plug
- Service ignition system
- Service fuel system
- Lubricate and service drive shaft
- Inspect and service safety systems
- Service starter system
- Service exhaust system

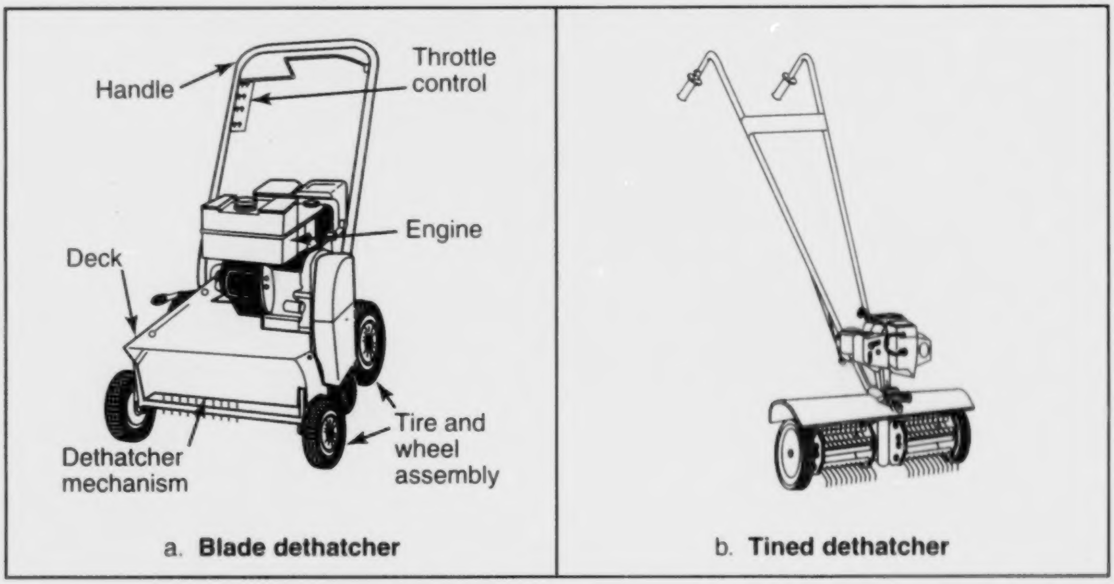
15. Major components of dethatchers and their functions (see Figure 5 on the next page)

Note: There are several types of dethatchers. The major types are described in further detail in Objectives 16 and 17. Most types of dethatchers use an overall configuration that resembles a walk-behind lawn mower—they ride on tire and wheel assemblies and are guided by the operator from behind by means of a raised-handle assembly.

- **Engine**—Provides the power to drive the dethatcher mechanism and, in some designs, to drive the wheels
- **Deck**—Supports the engine and other components
- **Throttle control**—Allows the operator to adjust the engine speed
- **Handle**—Allows the operator to push the dethatcher and guide its movement
- **Tire and wheel assemblies**—Support the dethatcher and allow it to travel over the surfaces to be groomed
- **Dethatcher mechanism**—Lifts thatch, leaves, grass clippings, and other debris from the lawn

  Note: Dethatchers use an impeller to create a low-pressure area under the deck. The impeller may be specifically for that purpose or it may be the blades of a shredder or mulcher. Most dethatchers also have a reel with extended tines designed to lift thatch from the lawn.

Figure 5: Dethatchers



a. **Blade dethatcher**

b. **Tined dethatcher**

16. Operating features used to classify dethatchers

Note: As the trend to offer versatile power equipment continues, dedicated dethatchers are becoming less common. The dethatcher function is often incorporated into other types of equipment as accessories. Thus, one way of classifying dethatchers is whether the equipment is dedicated or is an accessory for a lawn mower or shredder. A second way of classifying dethatchers is by the type of work they perform. There are dethatchers designed primarily to lift light debris from the lawn and those designed to dethatch the lawn. Naturally, there are models that offer both capabilities. These configurations are known respectively as *lawn vacuums*, *dethatchers*, and *combination vacuum/dethatchers* or simply *power rakes*.

- **Type of work mechanism—lawn vacuum or dethatcher**

  Note: Lawn vacuums use the movement of air to lift light debris, such as leaves and grass clippings, from the lawn. A dethatcher uses a horizontal shaft that is configured with short spikes or blades called *tines* (see Figure 5-b) sticking out from the shaft. As the shaft rotates, the tines break up the thatch, while the suction of an impeller pulls the loosened thatch up from the lawn. This operation not only removes the thatch but also benefits the lawn by breaking up tightly packed roots and by aerating the lawn—creating openings through which moisture, nutrients, and gases such as nitrogen can reach the root systems.

- **Configuration—dedicated unit or accessory**

  Note: Typically, this type of equipment is either a dedicated dethatcher unit or lawn vacuum with a dethatcher attachment. However, it is also common to have shredders that can be configured to work like a lawn vacuum or to have dethatcher attachments for walk-behind lawn mowers or as an implement for a riding lawn mower or garden tractor.

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17. Principles of operation of dethatchers

- **Dethatchers**—The power of the engine drives a belt or a chain that causes the dethatcher reel to rotate; the tines on the reel cut through the thatch and break it into small pieces; the engine also powers an impeller that creates a low-pressure area under the deck of the dethatcher so that loosened thatch is carried into the low-pressure area; the momentum of the moving debris carries it past the low-pressure area into the discharge stream, either to the rear or to one side of the equipment.

- **Lawn vacuums**—The engine powers an impeller that creates a low-pressure area under the deck of the equipment so that leaves, grass clippings, and other light debris are carried into the low-pressure area; the momentum of the moving debris carries it past the low-pressure area into the discharge stream, either to the rear or to one side of the equipment.

18. Typical service procedures required for dethatchers

- Inspect and replace dethatcher reel
- Inspect and replace impeller
- Inspect and replace drive mechanism
- Adjust drive mechanism
- Maintain oil level
- Change oil
- Clean air filter
- Change air filter
- Maintain spark plug
- Service ignition system
- Service fuel system
- Inspect and service safety systems
- Service starter system

19. Major components of blowers and their functions (see Figure 6 on the next page)

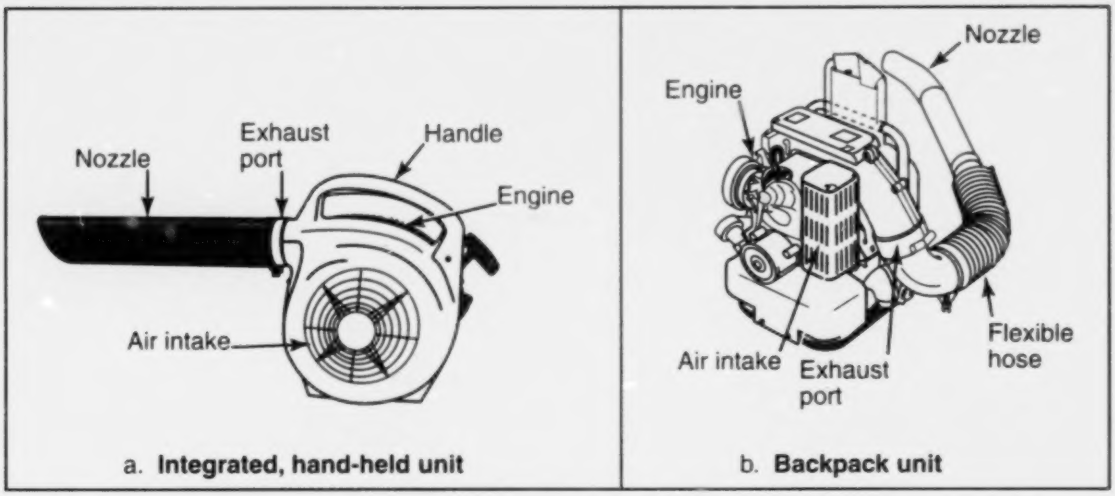
Note: Blowers are used to create a strong stream of forced air the operator uses in moving leaves, grass cuttings, and other light debris to a place where the debris can be collected.

- **Engine**—Provides the rotary power to drive the blower fan
- **Air-intake port**—Allows air to enter the blower housing
- **Blower fan**—Draws air into the blower housing and exhausts the air with force
- **Exhaust port**—Allows air to exit the blower housing

- **Nozzle**—Allows the operator to direct the air to the desired location

  Note: The nozzle extends from the main body of the blower and is used by the operator to direct the airflow from the blower to a desired location. Some blowers also offer extensions that can be added to lengthen the exhaust nozzle.

Figure 6: Blowers



a. **Integrated, hand-held unit**

b. **Backpack unit**

20. Operating feature used to classify blowers

- **Blower configuration—integrated, hand-held unit or backpack unit**

  Note: Blowers are usually configured as either an integrated, hand-held unit or a backpack unit. In an integrated unit, all the blower components are together in one unit, which the operator carries with a handle (see Figure 6-a). With a backpack unit, the engine is carried on the operator's back in backpack fashion and the nozzle is connected to a flexible hose that extends from the exhaust port (see Figure 6-b).

21. Principles of operation of blowers

- The engine provides rotary power to drive the blower fan; the rotating fan produces a flow of air; the airflow is directed out of the exhaust port and into the nozzle, which creates a restriction and increases the speed of the airflow.
- The operator directs the airflow by directing the nozzle to a desired location.

22. Typical service procedures required for blowers

- Service blower fan
- Check output force
- Maintain oil level
- Change oil
- Clean filter

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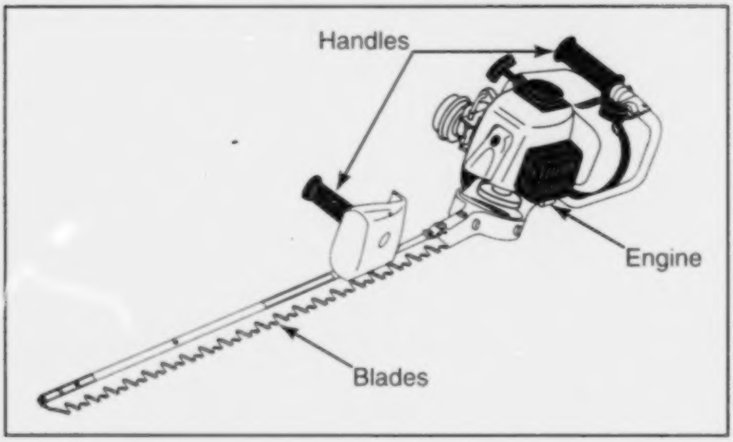
- Replace filter
- Maintain spark plug
- Service ignition system
- Service fuel system
- Inspect and service safety systems
- Service starter system

23. **Major components of hedge clippers and their functions** (see Figure 7)

- **Handles**—Allow the operator to hold and control the hedge clippers
- **Engine**—Provides the rotary power
- **Reciprocating blade**—Moves back and forth to provide the cutting action
- **Fixed blade**—Provides a fixed cutting surface

Figure 7: Major components of hedge clippers



24. **Operating features used to classify hedge clippers**

- **Cutting action—single action or double action**

  Note: With single-action equipment, the clippers can cut in only one direction; with double-action equipment, the clippers can cut with both the forward and backward movement of the equipment.

- **Gear arrangement—single stage or two stage**

  Note: Gears are used to change the speed or the amount of force in the cutting action of the reciprocating blade. Single-stage hedge clippers use one set of gears to transmit the power from the engine to the reciprocating blade; two-stage hedge clippers use two sets of gears to transmit power from the engine to the reciprocating blade. A two-stage system provides more variability in cutting speeds and cutting force.

25. Principles of operation of hedge clippers

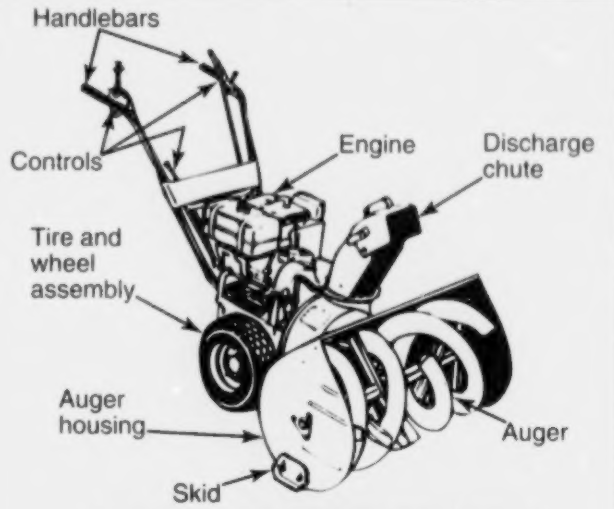
- Power from the engine causes a shaft to rotate; the rotating shaft is connected to a reciprocating mechanism—usually a crank or cam—that is connected to the reciprocating blade with a series of teeth on each side; the reciprocating blade rides in guides attached to the fixed blade, which also has a series of teeth on each side; leaves and small branches are caught between the teeth of the fixed blade and reciprocating blade and are sheared off by the reciprocating action.
- The operator controls the movement of the hedge clippers by using the handles.

26. Typical service procedures required for hedge clippers

- Sharpen blade
- Service reciprocating blade
- Maintain oil level
- Change oil
- Clean filter
- Replace filter
- Maintain spark plug
- Service ignition system
- Service fuel system
- Inspect and service safety systems
- Service starter system

27. Major components of snow blowers and their functions (see Figure 8)

Figure 8: Major components of snow blowers



Auger-type, single-stage snow blower

Information Sheet

- **Handlebars**—Allow the operator to guide the equipment movement

  Note: Some smaller models have upper and lower handles to provide better control over the equipment movement.

- **Controls**—Provide control over the operating parts

  Note: The available controls vary greatly among snow blowers. Generally, all will have a throttle control as a minimum. Some provide levers for adjusting vane or deflector positions or the amount of traction. Self-propelled models may have clutch levers or transmission shift levers and other controls.

- **Engine**—Provides the power to the equipment drive and the drive train, if so equipped

- **Discharge chute**—Provides the exit for the snow

  Note: Discharge chutes are usually adjustable. They can be rotated to throw the snow in a specific direction, and most have deflectors that can be raised or lowered to determine how far the snow travels.

- **Impeller**—Creates the airflow from the auger through the discharge chute and breaks up the snow

- **Auger**—Breaks up the snow and moves it toward the impeller

  Note: An auger is a device that rotates like a screw and breaks up and moves material as it rotates. The snow blower shown in Figure 8 uses an auger to break up the snow in front of the snow blower as it moves forward. Other designs use drums with blades or other variations. Each of these devices serve the same purpose—biting off snow ahead of the snow blower, breaking it up, and moving it toward the impeller or vanes that reduce it further.

- **Auger housing**—Helps to contain the snow as the auger moves the snow toward the impeller.

- **Skid**—Supports the auger housing on snow and ice

- **Tire and wheel assembly**—Supports the equipment and allows it to be moved easily

  Note: The design of the tire and wheel assembly depends on a number of factors. Small snow blowers are likely to have solid-rubber tires with solid rims, while heavier machines generally use pneumatic tires. Self-propelled equipment is likely to have tires with deep treads for better traction, and some accommodate chains to further increase traction.

28. Types of snow blowers and their descriptions

- **Paddle-type, single stage**—Equipment designed for snowfalls of 4 inches or less; generally equipped with an engine of 2 horsepower or less that rotates paddles to propel the scooped snow through vanes (see Figure 9-a on the next page)

- **Auger-type, single stage**—Equipment designed for snowfalls of up to approximately 14 inches; generally equipped with an engine in the 3- to 5-horsepower range that rotates an auger to force snow through a discharge chute and that may also propel the equipment (see Figure 8 on the previous page)

- **Auger-type, two stage**—Equipment designed for snowfalls of 3 feet or more; generally equipped with an engine in the 5- to 10-horsepower range that rotates a slow-turning auger that feeds snow back to a high-speed discharge impeller; usually self-propelled and often equipped with multiple-speed transmissions (see Figure 9-b on the next page)

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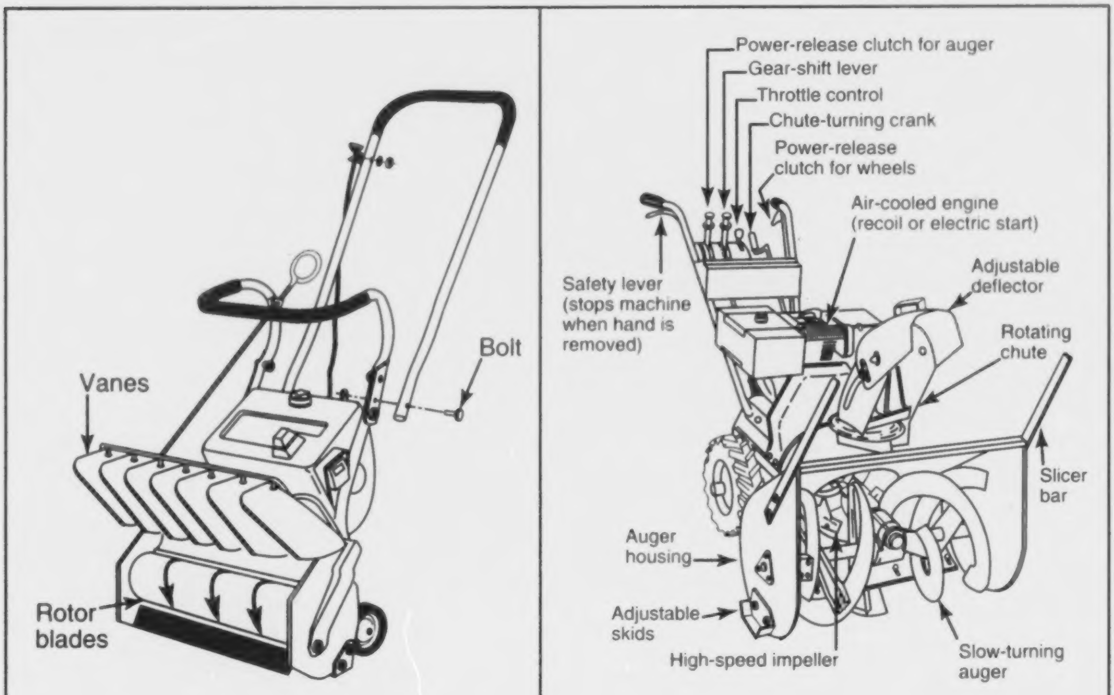
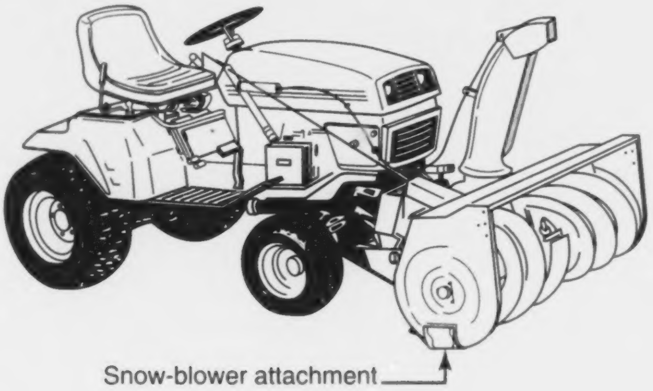
- **Tractor attachment**—Heavy-duty equipment that is powered by a garden tractor or similar equipment (see Figure 9-c)

Figure 9: Types of snow blowers


Vanes
Bolt
Rotor blades
Power-release clutch for auger
Gear-shift lever
Throttle control
Chute-turning crank
Power-release clutch for wheels
Air-cooled engine (recoil or electric start)
Safety lever (stops machine when hand is removed)
Adjustable deflector
Rotating chute
Slicer bar
Auger housing
Adjustable skids
High-speed impeller
Slow-turning auger

a. **Paddle-type, single-stage snow blower**

b. **Auger-type, two-stage snow blower**


Snow-blower attachment

c. **Tractor-attachment snow blower**

Information Sheet

29. Principles of operation of snow blowers

Note: A stage is a step in a process. Some processes have distinct stages during which the actions are generally quite different or which produce two distinct products. For example, some snow blowers are said to have two stages because they do not simply pick up the snow and throw it out of the way. They pick up snow during one stage and then send it through an impeller and to be discharged as the second stage.

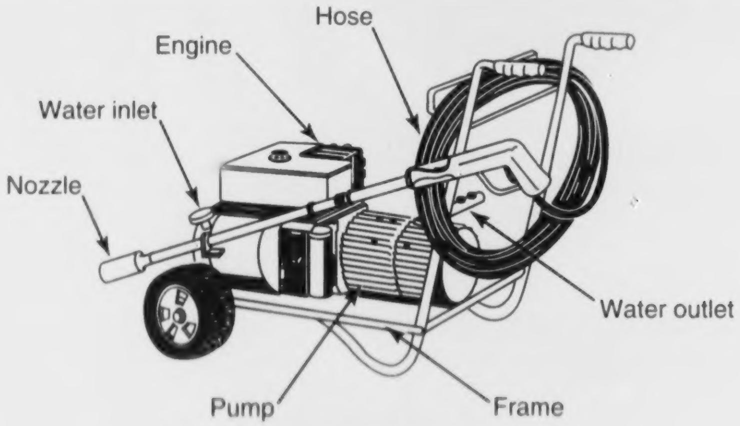
- **Single stage**
  - The engine drives the paddles or the auger.
  - As the operator pushes the snow blower, the paddles or the auger break up the snow.
  - With paddle designs, the snow is moved in chunks and thrown against deflector vanes that direct the snow to the left, right, or forward.
  - With auger designs, the snow is moved to the center of the auger where a disc that turns with the auger directs snow out a discharge chute, which is adjustable to the left, right, or forward.
  - For self-propelled models, a traction wheel is generally used to transfer power to a drive axle, with speed and direction adjusted by the position of the traction wheel and the use of a second traction disc to provide reverse.
- **Two stage**
  - The engine drives the auger at a low speed and the impeller at a high speed.
  - As the operator pushes the snow blower, the auger breaks up the snow and forces it to the center of the auger housing.
  - Snow is forced through the impeller and blown out the discharge chute, which can be directed left, right, or forward.
  - For self-propelled models, a traction wheel is generally used to transfer power to a drive axle, with speed and direction adjusted by the position of the traction wheel and the use of a second traction disc to provide reverse.
  - Electric starters are used with many models.

30. Typical service procedures required for snow blowers

- Service engine
- Service drive train
- Service starter
- Service equipment drive
- Service chassis
- Inspect and replace auger or paddles
- Inspect and replace impeller
- Service discharge chute

31. **Major components of pressure washers and their functions** (see Figure 10)

Figure 10: Major components of pressure washers



Wheelbarrow-type pressure washer

- **Engine**—Provides the power to the pump
- **Water inlet**—Allows the water to enter the pump

  Note: The water-inlet connection is generally the same type used on garden hoses. A hose is connected to the inlet to provide water from a tank or from a tap.

- **Pump**—Pressurizes the water

  Note: The pump is simply a hydraulic pump of any of various designs. Whatever the design, the pump will contain an unloader valve that closes off the inlet flow once full pressure is reached.

- **Water outlet**—Allows the pressurized water to exit the pump
- **Hose**—Transports the pressurized water to the nozzle and allows the operator to spray water at a distance from the washer

  Note: The hose is generally a reinforced rubber hose that can be of virtually any length and that is easily replaced, so a technician may encounter lots of nonstandard equipment. Many washers contain hooks or reels to wind the hose out of the way when it is not in use.

- **Nozzle**—Regulates the water spray pattern and allows the operator to open or close the water flow

  Note: The nozzle is generally a squeeze handle or trigger design. When the actuator is released, the flow of water is cut off and water pressure builds up in the pump until the unloader pressure is reached.

- **Frame**—Supports the engine, pump, and other components and allows the operator to move the unit

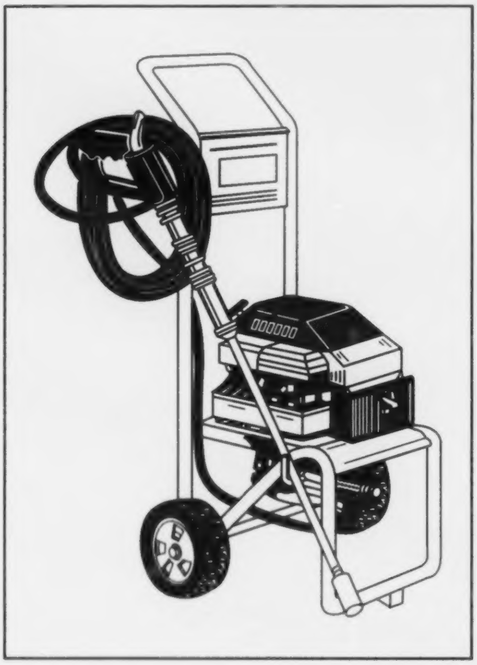
Information Sheet

32. Operating feature used to classify pressure washers

- **Frame configuration—dolly design or wheelbarrow design**

  Note: Many details of pressure washers can vary, such as the type of pump, the nozzle design, the hose length, etc. However, generally these are minor differences. Operationally, the two primary specifications with regard to pressure washers are the amount of pressure and rate of flow. Pressure is typically measured in pounds per square inch (psi). Pressures range from approximately 1000 psi to 4000 psi and depend primarily on the size of the engine. Flow rates are usually 2 to 4 gallons per minute. The most obvious difference in design is the configuration of the frame, which generally has a high handle with wheels at the rear like a dolly (see Figure 11) or a lower handle with wheels at the front like a wheelbarrow (see Figure 10 on the previous page).

  Figure 11: Dolly-type pressure washer



33. Principles of operation of pressure washers

- Water from a source, such as a tap or tank, enters the pump.

  Note: Some pressure washers are equipped with filters to clean the water and most have at least a screen over the inlet.

- The engine drives the pump, often directly off the engine-output shaft.
- The pump pressurizes the water and forces it through the outlet.
- With the nozzle closed, pressure continues to build until the pump reaches its maximum pressure.

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- At the maximum pressure, no additional water enters the pump and the unloader valve opens to allow water to recirculate in the pump.

  Note: If the unloader valve fails to operate or if another problem develops, most pumps have a relief valve. The relief valve opens and vents water to the outside once the pressure reaches a set level.

- If the nozzle is opened, pressurized water is released from the nozzle and water is allowed to enter the pump through the inlet.

34. Typical service procedures required for pressure washers

- Service engine
- Service pump
- Replace seals
- Replace or clean filter
- Replace hose or nozzle
- Replace relief valve

  Note: It is critical that the replacement valve meets the specifications of the system. If the relief valve opens too soon, then the system may not build up to the required pressure. If the relief pressure is too high, there is the danger that the pump, hose, or other parts of the system will fail.

- Service, repair, or replace unloader valve

Light-Duty Lawn and Garden Equipment
Unit 2

Job Sheet 1—Perform Routine Maintenance on Lawn Mowers

Introduction

This job sheet covers the routine maintenance associated with lawn mowers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Sharpen or replace blade
- Balance blade
- Adjust throttle linkage
- Lubricate chassis components

Procedure

1. Study all of the objectives in the information sheet.

2. Watch your instructor's demonstration of lawn-mower maintenance and any supporting media provided by your instructor.

3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one lawn mower. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.

4. Ask your instructor to provide you with a lawn mower that requires routine service.

5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.

6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.

7. Using the instructor-approved service information and equipment/materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 1

Worksheet—Perform Routine Maintenance on Lawn Mowers

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 1

Worksheet—Perform Routine Maintenance on Lawn Mowers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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Light-Duty Lawn and Garden Equipment
Unit 2

Job Sheet 2—Repair Lawn Mowers

Introduction

This job sheet covers the repair procedures associated with lawn mowers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Repair support systems, including fuel, starting, drive train, etc.
- Overhaul engine
- Perform adjustments to return equipment to original specifications
- Replace major components, such as blade shaft or wheels

Procedure

1. Study all of the objectives in the information sheet.
2. Watch your instructor's demonstration of lawn-mower repair and any supporting media provided by your instructor.
3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one lawn mower. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.
4. Ask your instructor to provide you with a lawn mower that requires repair.
5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.
6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.
7. Using the instructor-approved service information and equipment/materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 2

Worksheet—Repair Lawn Mowers

Name ______________________________ Attempt number __________

Date ______________________________

Part A: Pre-performance check

Job ______________________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________________

  Equipment model/type and code ______________________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________________

  Section/page number of procedure ______________________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

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Instructor's signature ______________________________

Job Sheet 2

Worksheet—Repair Lawn Mowers

Part B: **Performance evaluation**

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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Light-Duty Lawn and Garden Equipment
Unit 2

Job Sheet 3—Perform Routine Maintenance on Edgers

Introduction

This job sheet covers the routine maintenance associated with edgers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Sharpen shear blade
- Balance rotating blade
- Lubricate blade shaft, wheels, and pivoting head
- Adjust throttle and mechanical linkages

Procedure

1. Study all of the objectives in the information sheet.

2. Watch your instructor's demonstration of edger maintenance and any supporting media provided by your instructor.

3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one edger. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.

4. Ask your instructor to provide you with an edger that requires routine service.

5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.

6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.

7. Using the instructor-approved service information and equipment/materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 3

Worksheet—Perform Routine Maintenance on Edgers

Name ____________________ Attempt number __________

Date ____________________

Part A: **Pre-performance check**

Job ____________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ____________________

  Equipment model/type and code ____________________

  ____

- Complete the following service-manual information.

  Service-manual title ____________________

  Section/page number of procedure ____________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ____________________

Job Sheet 3

Worksheet—Perform Routine Maintenance on Edgers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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Light-Duty Lawn and Garden Equipment
Unit 2

Job Sheet 4—Repair Edgers

Introduction

This job sheet covers the repair procedures associated with edgers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Repair support systems, including fuel, starting, drive train, etc.
- Overhaul engine
- Perform adjustments to return equipment to original specifications
- Replace major components, such as blade shaft or wheels

Procedure

1. Study all of the objectives in the information sheet.

2. Watch your instructor's demonstration of edger repair and any supporting media provided by your instructor.

3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one edger. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.

4. Ask your instructor to provide you with an edger that requires repair.

5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.

6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.

7. Using the instructor-approved service information and equipment/ materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 4

Worksheet—Repair Edgers

Name Attempt number

Date

Part A: Pre-performance check

Job

- Complete the following information concerning the assigned equipment.

  Equipment brand

  Equipment model/type and code

- Complete the following service-manual information.

  Service-manual title

  Section/page number of procedure

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature

Job Sheet 4

Worksheet—Repair Edgers

Part B: **Performance evaluation**

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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Light-Duty Lawn and Garden Equipment
Unit 2

Job Sheet 5—Perform Routine Maintenance on Trimmers

Introduction

This job sheet covers the routine maintenance associated with trimmers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Service support systems
- Service engine
- Sharpen or replace blade or replace line
- Lubricate drive shaft

Procedure

1. Study all of the objectives in the information sheet.

2. Watch your instructor's demonstration of trimmer maintenance and any supporting media provided by your instructor.

3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one trimmer. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.

4. Ask your instructor to provide you with a trimmer that requires routine service.

5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.

6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.

7. Using the instructor-approved service information and equipment/materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 5

Worksheet—Perform Routine Maintenance on Trimmers

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 5

Worksheet—Perform Routine Maintenance on Trimmers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	
Procedures completed correctly.	
Proper tools used correctly.	
Safety precautions observed.	
Service meets specifications.	
Clean-up and follow-up actions adequate.	
Overall rating	

Evaluator's comments

Light-Duty Lawn and Garden Equipment
Unit 2

Job Sheet 6—Repair Trimmers

Introduction

This job sheet covers the repair procedures associated with trimmers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Repair support systems, including fuel, starting, drive train, etc.
- Overhaul engine
- Perform adjustments to return equipment to original specifications
- Replace major components, such as blade shaft or handle

Procedure

1. Study all of the objectives in the information sheet.

2. Watch your instructor's demonstration of trimmer repair and any supporting media provided by your instructor.

3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one trimmer. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.

4. Ask your instructor to provide you with a trimmer that requires repair.

5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.

6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.

7. Using the instructor-approved service information and equipment/materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 6

Worksheet—Repair Trimmers

Name ______________________________ Attempt number __________

Date ______________________________

Part A: Pre-performance check

Job ______________________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________________

  Equipment model/type and code ______________________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________________

  Section/page number of procedure ______________________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________________

Job Sheet 6

Worksheet—Repair Trimmers

Part B: **Performance evaluation**

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	________
Procedures completed correctly.	________
Proper tools used correctly.	________
Safety precautions observed.	________
Service meets specifications.	________
Clean-up and follow-up actions adequate.	________
Overall rating	________

Evaluator's comments ____

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Light-Duty Lawn and Garden Equipment
Unit 2

Job Sheet 7—Perform Routine Maintenance on Dethatchers

Introduction

This job sheet covers the routine maintenance associated with dethatchers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Service support systems
- Service engine
- Adjust drive mechanism
- Lubricate moving parts as required

Procedure

1. Study all of the objectives in the information sheet.

2. Watch your instructor's demonstration of dethatcher maintenance and any supporting media provided by your instructor.

3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one dethatcher. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.

4. Ask your instructor to provide you with a dethatcher that requires routine service.

5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.

6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.

7. Using the instructor-approved service information and equipment/ materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 7

Worksheet—Perform Routine Maintenance on Dethatchers

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

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Instructor's signature ______________________

Job Sheet 7

Worksheet—Perform Routine Maintenance on Dethatchers

Part B: **Performance evaluation**

Evaluation criteria **Rating**

Correct procedures identified for assigned equipment. ________

Procedures completed correctly. ________

Proper tools used correctly. ________

Safety precautions observed. ________

Service meets specifications. ________

Clean-up and follow-up actions adequate. ________

Overall rating ________

Evaluator's comments ____

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Light-Duty Lawn and Garden Equipment
Unit 2

Job Sheet 8—Repair Dethatchers

Introduction

This job sheet covers the repair procedures associated with dethatchers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Repair support systems, including fuel, starting, drive train, etc.
- Overhaul engine
- Perform adjustments to return equipment to original specifications
- Replace major components, such as impeller or dethatcher reel

Procedure

1. Study all of the objectives in the information sheet.

2. Watch your instructor's demonstration of dethatcher repair and any supporting media provided by your instructor.

3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one dethatcher. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.

4. Ask your instructor to provide you with a dethatcher that requires repair.

5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.

6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.

7. Using the instructor-approved service information and equipment/materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 8

Worksheet—Repair Dethatchers

Name ____________________ Attempt number __________

Date ____________________

Part A: Pre-performance check

Job ____________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ____________________

  Equipment model/type and code ____________________

  ____

- Complete the following service-manual information.

  Service-manual title ____________________

  Section/page number of procedure ____________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ____________________

Job Sheet 8

Worksheet—Repair Dethatchers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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Light-Duty Lawn and Garden Equipment
Unit 2

Job Sheet 9—Perform Routine Maintenance on Blowers

Introduction This job sheet covers the routine maintenance associated with blowers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Service support systems
- Service engine
- Lubricate moving parts as required

Procedure

1. Study all of the objectives in the information sheet.
2. Watch your instructor's demonstration of blower maintenance and any supporting media provided by your instructor.
3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one blower. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.
4. Ask your instructor to provide you with a blower that requires routine service.
5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.
6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.
7. Using the instructor-approved service information and equipment/materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 9

Worksheet—Perform Routine Maintenance on Blowers

Name ______________________________ Attempt number __________

Date ______________________________

Part A: Pre-performance check

Job ______________________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________________

  Equipment model/type and code ______________________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________________

  Section/page number of procedure ______________________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________________

Job Sheet 9

Worksheet—Perform Routine Maintenance on Blowers

Part B: **Performance evaluation**

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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Light-Duty Lawn and Garden Equipment
Unit 2

Job Sheet 10—Repair Blowers

Introduction

This job sheet covers the repair procedures associated with blowers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Repair support systems, including fuel, starting, drive train, etc.
- Overhaul engine
- Perform adjustments to return equipment to original specifications
- Replace major components, such as impeller or air tubes and hoses

Procedure

1. Study all of the objectives in the information sheet.
2. Watch your instructor's demonstration of blower repair and any supporting media provided by your instructor.
3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one blower. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.
4. Ask your instructor to provide you with a blower that requires repair.
5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.
6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.
7. Using the instructor-approved service information and equipment/materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 10

Worksheet—Repair Blowers

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 10

Worksheet—Repair Blowers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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____

Light-Duty Lawn and Garden Equipment
Unit 2

Job Sheet 11—Perform Routine Maintenance on Hedge Clippers

Introduction

This job sheet covers the routine maintenance associated with hedge clippers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Service support systems
- Service engine
- Lubricate reciprocating mechanism
- Sharpen blades
- Adjust blade clearance

Procedure

1. Study all of the objectives in the information sheet.

2. Watch your instructor's demonstration of hedge-clipper maintenance and any supporting media provided by your instructor.

3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one hedge clipper. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.

4. Ask your instructor to provide you with hedge clippers that require routine service.

5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.

6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.

7. Using the instructor-approved service information and equipment/materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 11

Worksheet—Perform Routine Maintenance on Hedge Clippers

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 11

Worksheet—Perform Routine Maintenance on Hedge Clippers

Part B: Performance evaluation

Evaluation criteria **Rating**

Correct procedures identified for assigned equipment. ______

Procedures completed correctly. ______

Proper tools used correctly. ______

Safety precautions observed. ______

Service meets specifications. ______

Clean-up and follow-up actions adequate. ______

Overall rating ______

Evaluator's comments ____

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Light-Duty Lawn and Garden Equipment
Unit 2

Job Sheet 12—Repair Hedge Clippers

Introduction

This job sheet covers the repair procedures associated with hedge clippers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Repair support systems, including fuel, starting, drive train, etc.
- Overhaul engine
- Perform adjustments to return equipment to original specifications
- Replace major components, such as reciprocating mechanism or blades

Procedure

1. Study all of the objectives in the information sheet.

2. Watch your instructor's demonstration of hedge-clipper repair and any supporting media provided by your instructor.

3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one hedge clipper. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.

4. Ask your instructor to provide you with hedge clippers that require repair.

5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.

6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.

7. Using the instructor-approved service information and equipment/ materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 12

Worksheet—Repair Hedge Clippers

Name ________________________ Attempt number ________

Date ________________________

Part A: Pre-performance check

Job ________________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ________________________

  Equipment model/type and code ________________________

  ____

- Complete the following service-manual information.

  Service-manual title ________________________

  Section/page number of procedure ________________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ________________________

Job Sheet 12

Worksheet—Repair Hedge Clippers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

____

____

Light-Duty Lawn and Garden Equipment
Unit 2

Job Sheet 13—Perform Routine Maintenance on Snow Blowers

Introduction

This job sheet covers the routine maintenance associated with snow blowers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Inspect components
- Lubricate gears, chains, and bearings
- Adjust belt tension
- Align pulleys and shafts
- Inspect paddles or augers
- Inspect impeller

Procedure

1. Study all of the objectives in the information sheet.

2. Watch your instructor's demonstration of performing routine maintenance on snow blowers and any supporting media provided by your instructor.

3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one snow blower. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.

4. Ask your instructor to provide you with a snow blower.

5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.

6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.

7. Using the instructor-approved service information and equipment/materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 13

Worksheet—Perform Routine Maintenance on Snow Blowers

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 13

Worksheet—Perform Routine Maintenance on Snow Blowers

Part B: **Performance evaluation**

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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____

Light-Duty Lawn and Garden Equipment
Unit 2

Job Sheet 14—Repair Snow Blowers

Introduction

This job sheet covers the repair procedures associated with snow blowers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Replace components, including gears, belts, augers, etc.
- Overhaul engine
- Overhaul equipment drive
- Overhaul drive train
- Perform adjustments to return equipment to original specifications

Procedure

1. Study all of the objectives in the information sheet.
2. Watch your instructor's demonstration of repairing snow blowers and any supporting media provided by your instructor.
3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one snow blower. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.
4. Ask your instructor to provide you with a snow blower.
5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.
6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.
7. Using the instructor-approved service information and equipment/ materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 14

Worksheet—Repair Snow Blowers

Name ______________________________ Attempt number __________

Date ______________________________

Part A: Pre-performance check

Job ____

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________________

  Equipment model/type and code ______________________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________________

  Section/page number of procedure ______________________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________________

Job Sheet 14

Worksheet—Repair Snow Blowers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

____

____

Light-Duty Lawn and Garden Equipment
Unit 2

Job Sheet 15—Perform Routine Maintenance on Pressure Washers

Introduction

This job sheet covers the routine maintenance associated with pressure washers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Inspect components
- Lubricate gears, chains, and linkages
- Adjust belt tension
- Align pulleys and shafts

Procedure

1. Study all of the objectives in the information sheet.

2. Watch your instructor's demonstration of performing routine maintenance on pressure washers and any supporting media provided by your instructor.

3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one pressure washer. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.

4. Ask your instructor to provide you with a pressure washer.

5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned..

6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.

7. Using the instructor-approved service information and equipment/ materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 15

Worksheet—Perform Routine Maintenance on Pressure Washers

Name ______________________________ Attempt number ____________

Date ______________________________

Part A: Pre-performance check

Job ____

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________________________

  Equipment model/type and code ______________________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________________________

  Section/page number of procedure ____________________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________________________

Job Sheet 15

Worksheet—Perform Routine Maintenance on Pressure Washers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

____

____

Light-Duty Lawn and Garden Equipment
Unit 2

Job Sheet 16—Repair Pressure Washers

Introduction

This job sheet covers the repair procedures associated with pressure washers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Replace components, including gears, belts, seals, etc.
- Overhaul engine
- Overhaul equipment drive
- Overhaul pump and unloader valve
- Perform adjustments to return equipment to original specifications

Procedure

1. Study all of the objectives in the information sheet.

2. Watch your instructor's demonstration of repairing pressure washers and any supporting media provided by your instructor.

3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one pressure washer. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.

4. Ask your instructor to provide you with a pressure washer.

5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.

6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.

7. Using the instructor-approved service information and equipment/materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 16

Worksheet—Repair Pressure Washers

Name ______________________ Attempt number ________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 16

Worksheet—Repair Pressure Washers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	_______
Procedures completed correctly.	_______
Proper tools used correctly.	_______
Safety precautions observed.	_______
Service meets specifications.	_______
Clean-up and follow-up actions adequate.	_______
Overall rating	_______

Evaluator's comments ____

____

____

Heavy-Duty Lawn and Garden Equipment
Unit 3

Objective Sheet

Unit objective

After completing this unit, the student should be able to describe the design and operation of common types of heavy-duty lawn and garden equipment and be able to perform routine maintenance and service procedures on such equipment. The student should demonstrate these competencies by completing the job sheets and by scoring a minimum of 85 percent on the written test.

Specific objectives

After completing this unit, the student should be able to

1. State safety rules for servicing heavy-duty lawn and garden equipment.
2. State the functions of the major components of garden tractors.
3. State the operating feature used to classify garden tractors.
4. Complete statements about the principles of operation of garden tractors.
5. State the functions of the major components of riding lawn mowers.
6. State the operating feature used to classify riding lawn mowers.
7. Complete statements about the principles of operation of riding lawn mowers.
8. List typical service procedures required for garden tractors and riding lawn mowers.
9. State the functions of the major components of tillers.
10. State the operating feature used to classify tillers.
11. Complete statements about the principles of operation of tillers.
12. List typical service procedures required for tillers.
13. State the functions of the major components of log splitters.
14. State the operating feature used to classify log splitters.
15. Complete statements about the principles of operation of log splitters.
16. List typical service procedures required for log splitters.
17. State the functions of the major components of shredders.
18. Match types of shredders to their correct descriptions.
19. Complete statements about the principles of operation of shredders.
20. List typical service procedures required for shredders.

Objective Sheet

21. Perform routine maintenance on garden tractors and riding lawn mowers. (Job Sheet 1)
22. Repair garden tractors and riding lawn mowers. (Job Sheet 2)
23. Perform routine maintenance on tillers. (Job Sheet 3)
24. Repair tillers. (Job Sheet 4)
25. Perform routine maintenance on log splitters. (Job Sheet 5)
26. Repair log splitters. (Job Sheet 6)
27. Perform routine maintenance on shredders. (Job Sheet 7)
28. Repair shredders. (Job Sheet 8)

Heavy-Duty Lawn and Garden Equipment
Unit 3

Information Sheet

1. **Safety rules for servicing heavy-duty lawn and garden equipment**

- **Remove the spark plug whenever performing service that does not require the engine to be running, including removing material from blades, adjusting belts, etc.**

  Note: Because of the danger presented by blades and moving parts that can crush or injure, the technician should disable the engine by removing the source of ignition so that the engine will not be inadvertently started.

- **Do not expose the fuel to heat, flames, or sparks.**

- **Be careful when working around moving belts, chains, shafts, gears, and other parts.**

- **Be careful when handling and working near sharp surfaces such as blades and shears.**

- **Do not operate equipment with the guards and shields removed.**

  Note: Most types of power product equipment include protective devices to reduce the likelihood of accidents. While it may seem like a waste of time to reinstall shields to test the equipment during service, if the technician suffers a serious injury, the loss of time could be substantially more.

- **Do not start equipment under an excessive load, such as a mower with its blade in a bind.**

- **When operating equipment that discharges debris, do not direct the discharge toward people in the area.**

  Note: Power product equipment can discharge materials at high speeds. A rotary-mower blade traveling 3000 rpm can send a rock through the air at more than 100 miles per hour.

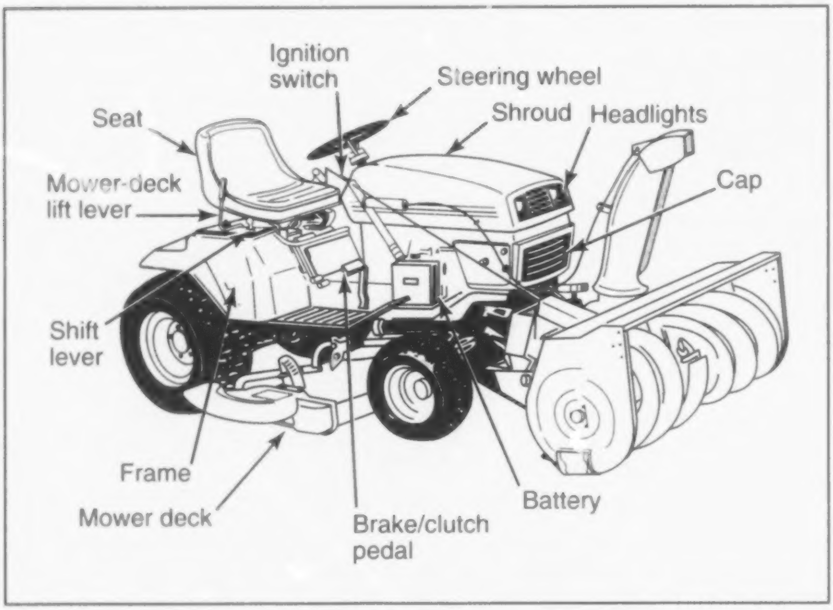
- **Use proper lifting procedures, and do not try to lift or carry excessive loads.**

- **When driving operator-ridden equipment, do not exceed the incline limits of the equipment or change the center of gravity by making the equipment top heavy.**

  Note: Most types of operator-ridden equipment will specify limits for the incline on which they can be operated. If the angle of operation is greater than that prescribed, there is a danger the equipment will roll over. Many pieces of equipment show a tendency to roll sideways and backwards, especially if the operator sits at the rear of the equipment.

2. **Major components of garden tractors and their functions** (see Figure 1)

Figure 1: Major components of garden tractors



- **Seat**—Supports the operator

  Note: The seat assembly supports the operator and, on many models, also provides a useful space for other purposes. Some garden tractors have the battery or even the engine under the seat. The linkage for the mower-deck lift, hydraulics, the gearbox for a rear PTO, and other mechanisms may be housed in this area.

- **Ignition switch**—Allows the operator to start or shut off the engine

  Note: The ignition switch is generally mounted on the dashboard area near the steering wheel. The dashboard may also feature instruments such as an ammeter or fuel gauge and other controls such as the throttle lever, choke control, and headlight switch.

- **Steering wheel**—Provides the operator with a means of guiding the direction of equipment travel

- **Shroud**—Covers and protects the engine compartment

  Note: The shroud is often hinged to provide a hood that can be raised to provide access to the engine.

- **Headlights**—Provide the illumination so the equipment can be operated in low-light conditions

- **Cap**—Protects the front of the engine compartment and provides ventilation

- **Front axle**—Provides steering control and supports the front tire and wheel assemblies

Information Sheet

- **Frame**—Supports the engine and other system components

  Note: The frame forms the foundation for all other systems and is the ground for electrical systems. Many garden tractors have reinforced frames at the front and rear for attachments such as plows, trailers, blades, tillers, lifts, and other equipment.

- **Engine**—Provides the power to the drive train and the equipment drives

- **Battery**—Provides the power to start the engine

- **Brake/clutch pedal**—Engages the brake and disengages the transmission clutch when applied

  Note: Numerous configurations of pedal arrangements are used on garden tractors. On some models, this is a single brake/clutch pedal, usually located to the operator's left when he or she is seated to drive the equipment. Other models have a brake/clutch pedal on each side of the equipment that are interconnected so that the operator can use either foot to apply the brakes and disengage the clutch. A variation of this design is to have two brake pedals, one for each rear wheel so that sharper turns can be made by slowing one drive wheel while the other continues to drive at normal speed. Some models may have a clutch pedal on one side and a brake pedal on the other or a brake/clutch pedal on one side and a throttle pedal on the other. Additional variations exist.

- **Mower deck**—Houses the mower blades and the equipment-drive connection

- **Transaxle**—Regulates the power from the engine that is delivered to the drive wheels

  Note: In models with transmissions, the differential would be located in approximately the same position as part of the rear axle. Gear transmissions are generally located under the seat assembly or next to the steering column. The shift lever is then normally on the dashboard or comes up through the floor in front of the seat assembly.

- **Rear axle**—Serves as the final drive and supports the rear tire and wheel assemblies

- **Shift lever**—Allows the operator to select transaxle-speed or transmission-speed setting

- **Mower-deck lift lever**—Allows the operator to raise or lower the mower deck or attachments

  Note: Levers and other controls may be provided for hydraulic equipment, PTOs, or other equipment drives. Mower-deck lift systems are normally mechanical for belly mowers, though hydraulic systems can be used, especially for rear-mounted mower decks.

3. Operating feature used to classify garden tractors

Note: There is no standard definition of what constitutes equipment called a *garden tractor* versus equipment called a *riding lawn mower* or, as some texts call them, *lawn tractors*. In this course, the term *garden tractor* refers to that family of equipment modeled after the traditional farm tractor, generally having a front engine of at least 8 horsepower, a multiple-speed transmission or transaxle, an electric starter, and over-size rear tires for better traction and balance on a variety of surfaces. While many garden tractors have mowers attached to them, as used in this text, garden tractors are designed to operate additional attachments, such as plows, tillers, front or rear scrape blades, etc. These attachments may be powered by the tractor engine, an electric motor, hydraulics, or ground drive. Using this definition, the primary distinction in garden-tractor designs is the arrangement of the drive train. Naturally, there are differences in engine sizes, type of transmission or transaxle, etc.

Information Sheet

- **Drive-train arrangement—rear-wheel drive, full-time four-wheel drive, or part-time four-wheel drive**

  Note: With the rear-wheel-drive arrangement, the final drive is provided by the rear wheels; with full-time four-wheel drive, the final drive is provided by all four wheels at all times; and with part-time four-wheel drive, the final drive may be provided by the rear wheels or by all four wheels, as selected by the operator.

  Four-wheel drive provides more traction than two-wheel drive and is helpful in slippery conditions, such as wet or icy surfaces, snow, mud, etc. However, four-wheel drive is less efficient, leading to increased fuel consumption and a loss of power available to other applications such as equipment drives. Therefore, part-time four-wheel drive offers the advantage of using four-wheel drive only when required. The reason that part-time four-wheel drive is not always used in place of full-time four-wheel drive is that part-time systems require more parts, making them slightly more complicated and generally heavier.

4. **Principles of operation of garden tractors**

- A key switch or push button is used to make contact with an electric starter; the starter engages the engine flywheel to start the engine.
- Power from the engine is transferred to the drive train and applied to the drive wheels for movement.
- The transmission or transaxle allows control of forward and reverse directions and speeds.
- A steering system provides control over side-to-side turning.
- A brake system provides the force to slow or stop the tractor.

  Note: Many garden tractors and other operator-ridden equipment use a combination brake/clutch pedal. Typically, in such systems, touching the pedal slightly begins brake application, thus slowing the equipment. If the pedal is pushed in all the way, the brakes are fully applied and the clutch disengages.

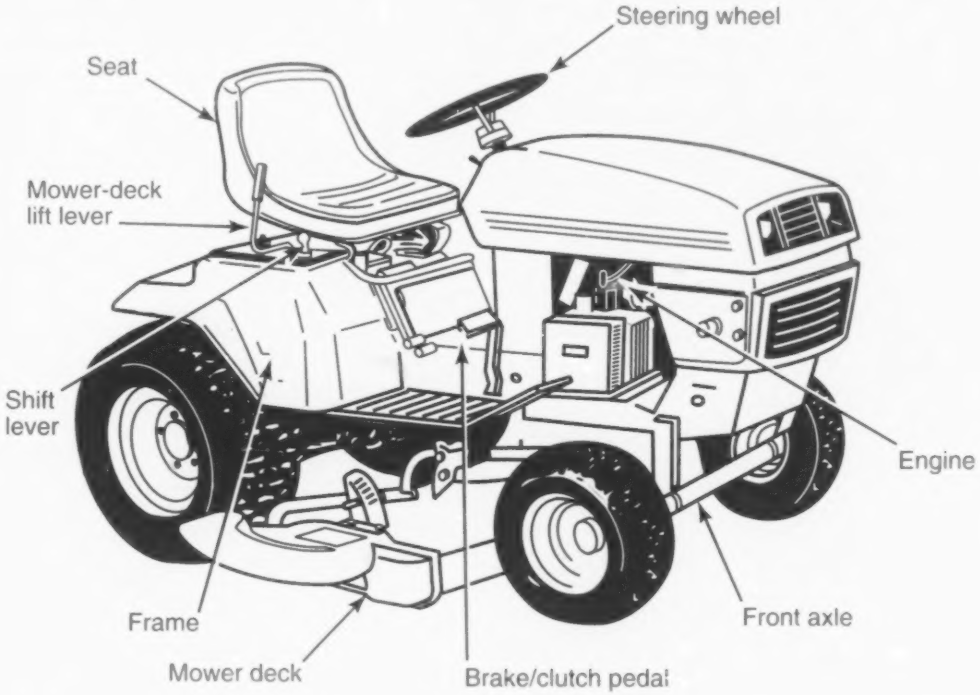
- The tractor generally includes a charging system to restore the battery, either as an alternator or as an externally powered charger.
- Power from the engine is also made available to equipment drives, such as mowers and PTOs.
- Actuators are often provided for control of the attachments, such as raising or lowering the mower deck, operating lift equipment, engaging or disengaging the PTO, etc.

5. **Major components of riding lawn mowers and their functions** (see Figure 2 on the next page)

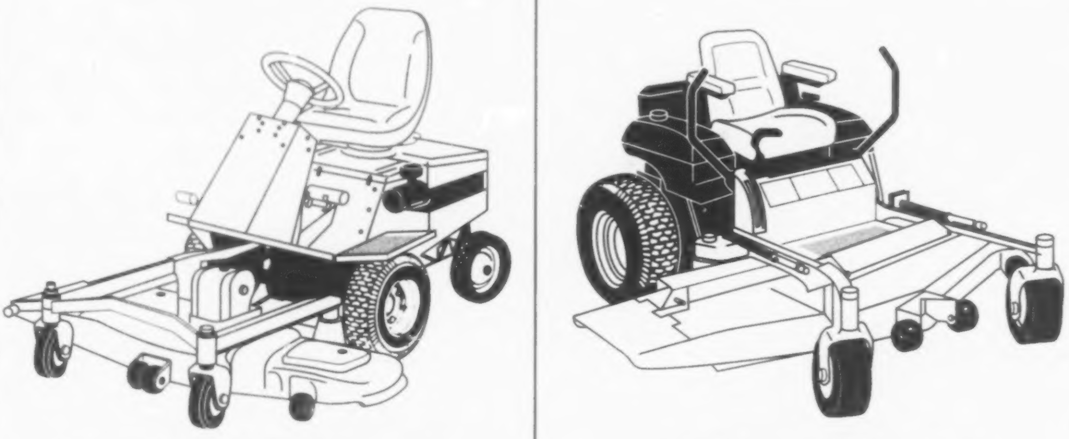
Note: The mower shown in Figure 2-a is representative of a medium-power front-engine riding lawn mower in the middle-price range. It provides the basic necessities for cutting grass without a lot of extra conveniences. It is distinguishable from the garden tractor in that it is basically a platform for carrying the mower deck and the operator. There are great variations in designs for riding lawn mowers (see Figures 2-b and 2-c on the next page), but the model shown in Figure 2-a illustrates the basic components.

Information Sheet

Figure 2: Major components of riding lawn mowers


Steering wheel
Seat
Mower-deck lift lever
Shift lever
Engine
Front axle
Frame
Mower deck
Brake/clutch pedal

a. **Front-engine riding lawn mower**



b. **Rear-engine riding lawn mower**

c. **ZTR (zero-turning-radius) riding lawn mower**

Information Sheet

- **Seat**—Supports the operator

  Note: The seat assembly does support the operator, but on many models, it may also provide a useful space for other purposes.

- **Steering wheel**—Provides the operator with a means of guiding the direction of equipment travel

- **Front axle**—Provides the steering control and supports the front tire and wheel assemblies

- **Frame**—Supports the engine and the other system components

  Note: The frame forms the foundation for all other systems as well as the ground for electrical systems. Typically, the frame of a riding lawn mower is lighter than that of a garden tractor. The chassis consists primarily of a plate with treads and a support for the steering shaft.

- **Engine**—Provides the power to the drive train and the mower drive

  Note: Some riding lawn mowers use a rope-recoil starter, which is not overly inconvenient considering the generally small engines used for riding lawn mowers. Some riding lawn mowers do have electric starters.

- **Brake/clutch pedal**—Engages the brake and disengages the transmission clutch when applied

  Note: Riding lawn mowers tend to have simple brake and clutch systems. Typically, at the low end of the price scale, a riding lawn mower will have a mechanical external-band brake and an idler pulley for the clutch system. However, some models do have more complex brake and clutch systems.

- **Mower deck**—Houses the mower blades and the equipment-drive connection

- **Rear axle**—Serves as the final drive and supports the rear tire and wheel assemblies

  Note: While many riding lawn mowers have multiple-speed transmissions, some have single-speed transmissions that basically consist of a direct chain or belt drive that turns the drive axle. Most riding lawn mowers will have differentials built into the rear axle. In models with multiple-speed transmissions or transaxles, the applicable supporting components, such as the shift lever, would also be present.

- **Shift lever**—Allows the operator to select the transaxle-speed or transmission-speed setting

- **Mower-deck lift lever**—Allows the operator to raise or lower the mower deck

6. **Operating feature used to classify riding lawn mowers**

   - **Engine placement—front engine or rear engine**

     Note: Front-engine riding lawn mowers are often constructed to look like garden tractors (see Figure 2-a), but they do not have the capacity to support additional equipment drives other than the mower deck. Rear-engine riding lawn mowers (see Figures 2-b and 2-c) typically house the engine under the seat structure. The amount of structure in front of the seat is minimized, often consisting of nothing more than the steering column or levers and the frame and tread.

Information Sheet

7. Principles of operation of riding lawn mowers

Note: Riding lawn mowers offer some of the same driver-convenience features as garden tractors but usually in lighter, less-complicated packages. For example, riding-lawn-mower engines tend to be in a smaller horsepower range. They usually offer one to three forward speeds instead of the five or more that are common on garden tractors. The steering, starting, brake, and charging systems are likely to be simpler and involve fewer components. Garden tractors often have headlamps and gauges or instruments that are not normally found on riding lawn mowers.

- The mower may be equipped with a manual starter, an electric starter, or both types of starters.
- Power from the engine is transferred to the drive train and applied to the drive wheels for movement.
- The transmission or transaxle allows control of power to the drive wheels and may offer both forward and reverse and multiple speeds for forward.
- A steering system provides control over side-to-side turning.

  Note: Because riding lawn mowers are designed specifically for cutting grass, many of their systems are designed to enhance their ability to perform this function. For example, a tight turning radius makes a mower easier to operate in close places and in maneuvering around objects such as trees and flowerbeds. Some models offer zero turning radius (ZTR), meaning that the equipment can make a complete circle with a radius no greater than the width of the equipment. Therefore, riding lawn mowers often use drive-wheel, hydraulic steering, or four-wheel steering systems to shorten the turning radius. As a result, steering-control mechanisms are likely to differ from the common steering-wheel-and-shaft design, and often consist of steering levers.

- A brake system provides force to slow or stop the riding lawn mower.
- Power from the engine is transferred to the mower.

  Note: The mower is generally a deck attached to the underside of the unit; however, many riding lawn mowers use other mower configurations. For example, some use reel-type mowers in front of the equipment frame or, in some cases, in front of and at the side of the frame, with several reel units called *gang mowers*. Gang mowers are also pulled behind some riding-lawn-mower models.

- Actuators may be provided to engage or disengage the mower blade and for raising or lowering the mower deck.

8. Typical service procedures required for garden tractors and riding lawn mowers

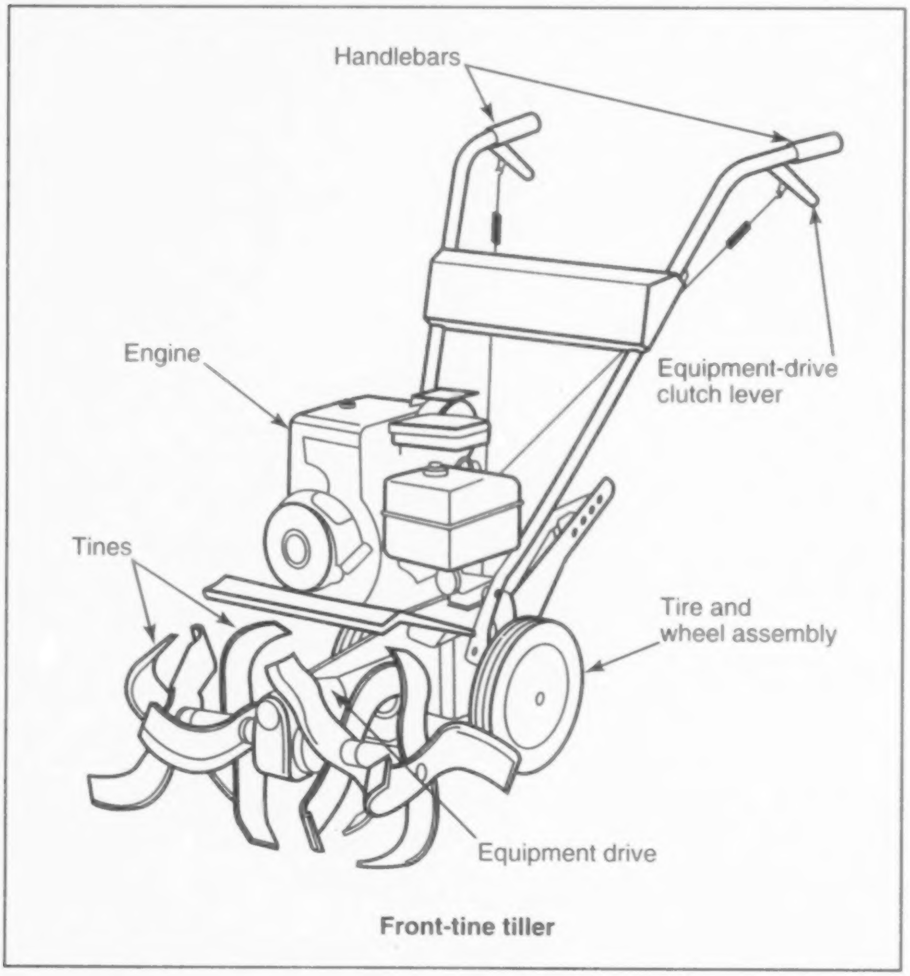
- Service engine
- Service transmission/transaxle
- Service steering system, including wheel alignment
- Service starting system
- Service charging system

- Service brake system
- Service tire
- Service electrical system
- Service chassis
- Service equipment drive
- Service blade

Note: In addition to blade sharpening and balancing, some mower decks and attachments use more than one blade, and often the technician must time these blades so that the blades do not strike each other during operation.

9. **Major components of tillers and their functions** (see Figure 3)

Figure 3: Major components of tillers


Handlebars
Engine
Equipment-drive clutch lever
Tines
Tire and wheel assembly
Equipment drive

Front-tine tiller

Information Sheet

- **Handlebars**—Allow the operator to guide the tiller
- **Throttle control**—Allows the operator to adjust the engine speed
- **Tines**—Break up the soil

  Note: Tillers are usually equipped with two to four tine assemblies. Each tine assembly has four or more tines and is mounted to the drive axle. The tines are thin, curved blades that are sharp along one edge. There are two types of tines. One type, called a *bolo tine*, is nearly straight to provide a pick-like action. The other type, called a *slasher tine* (see Figure 3 on the previous page), has a long, sharp curve at the end of the tine to chop off layers of soil with each pass. The tines of an assembly may be configured with the curves of the tines in one direction or with alternating tines having curves in opposite directions.

- **Equipment-drive clutch lever**—Allows the operator to engage or disengage the tines

  Note: The clutch lever is generally attached to one handle on the handlebars. When the operator squeezes the lever, the equipment drive is engaged and the tines rotate.

- **Engine**—Provides the power to the equipment drive
- **Equipment drive**—Transmits the power from the engine to the tine drive axle

  Note: Many tillers have a two-section equipment drive. The first section uses a V-belt to transmit power from the engine to a pulley with a chain sprocket mounted on the other end of the pulley shaft. The sprocket drives a chain that in turn drives the tine axle. The chain is generally enclosed in a sealed casing filled with lubricant. The casing protects the chain from dirt and dust and chunks of soil thrown up by the tines.

- **Tire and wheel assemblies**—Support the equipment and allow it to be moved with less effort

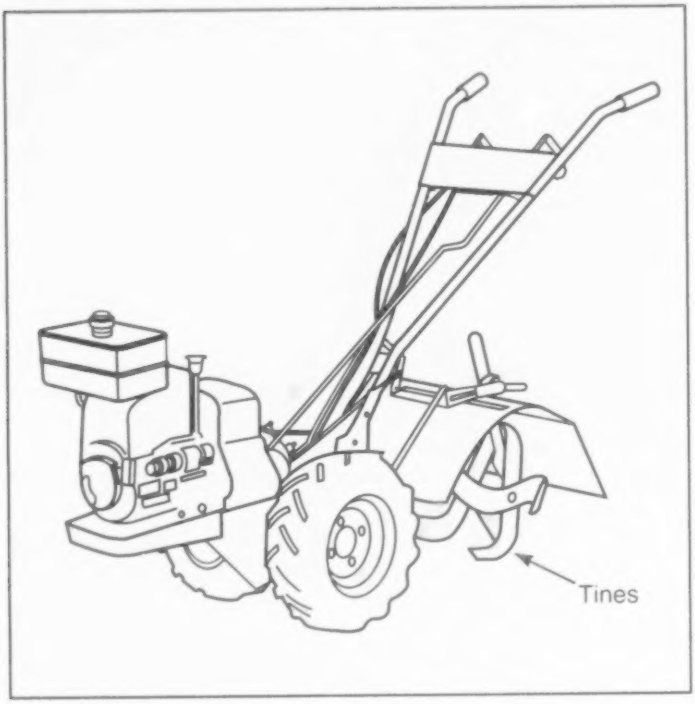
  Note: While some large tillers have pneumatic tires, most use solid-rubber tires with solid rims. Obviously, tire and wheel assemblies support and make most wheeled equipment more mobile, but the tire and wheel assemblies serve an additional purpose for tillers. Because the tines are designed to operate below grade (beneath the surface of the soil), a tiller is really a large lever. The handlebars form the long end of the lever and the wheels act as the pivot point or fulcrum. By raising or lowering the handlebars, the operator can force the tines deeper into the soil or can raise the tines completely free of the ground to move the tiller. For this reason, most tillers are equipped with a depth-guide bar, which is generally a metal bar near the base of the handlebars that can be set at different heights to determine the tilling depth.

10. **Operating feature used to classify tillers**

- **Tine placement—front tine or rear tine**

  Note: Front-tine models (see Figure 3 on the previous page) have the tines in front of the wheels. The wheels serve as the pivot point of the lever so that the tines are forced deeper into the soil by raising the handlebars. Rear-tine models have the tines in front of the wheels (see Figure 4 on the next page). The wheels serve as the pivot point of the lever so that the tines are forced deeper into the soil by pushing down on the handlebars. Although the choice of a front-tine or rear-tine model is largely a matter of personal preference, rear-tine tillers tend to be better suited for deep tilling of the soil, and front-tine tillers do a better job of "hoeing" young weeds.

Figure 4: Rear-tine tiller



11. Principles of operation of tillers

- The engine outputs power to the equipment drive; a belt, chain, shaft, or gear transmits power to the tine axle.

  Note: The tine axle is generally a straight metal rod with a sprocket in the middle. The axle passes through the equipment-drive casing with the sprocket in the casing and meshed with the drive chain. The axle has holes bored through it at specific locations. The tine assemblies have hollow hubs that fit over the axle. When the holes in the hub align with the holes in the axle, a pin can be inserted to hold the tine in place. One side of the hub is longer than the other on some tine assemblies so that the tines themselves are positioned at different locations depending on which side of the hub is installed first on the axle. This and differences in tine-assembly design allow the operator to change the width of the tilled area and the pattern of the tilled area.

- The operator squeezes a lever that increases the tension on the equipment-drive belt; the action of the tensioner clutch engages or disengages the equipment-drive belt.

- The operator uses the handlebars to guide the tiller.

- A throttle control regulates engine speed and, in turn, tine-rotation speed.

  Note: Some tillers have variable-speed transmissions, usually with a low and a high setting. This arrangement allows the engine to be operated at a higher speed, for example, while the tines rotate more slowly but with more force.

- A guide bar is generally provided to control the tilling depth.

Information Sheet

12. Typical service procedures required for tillers

- Service engine
- Service equipment drive
- Inspect and replace tines

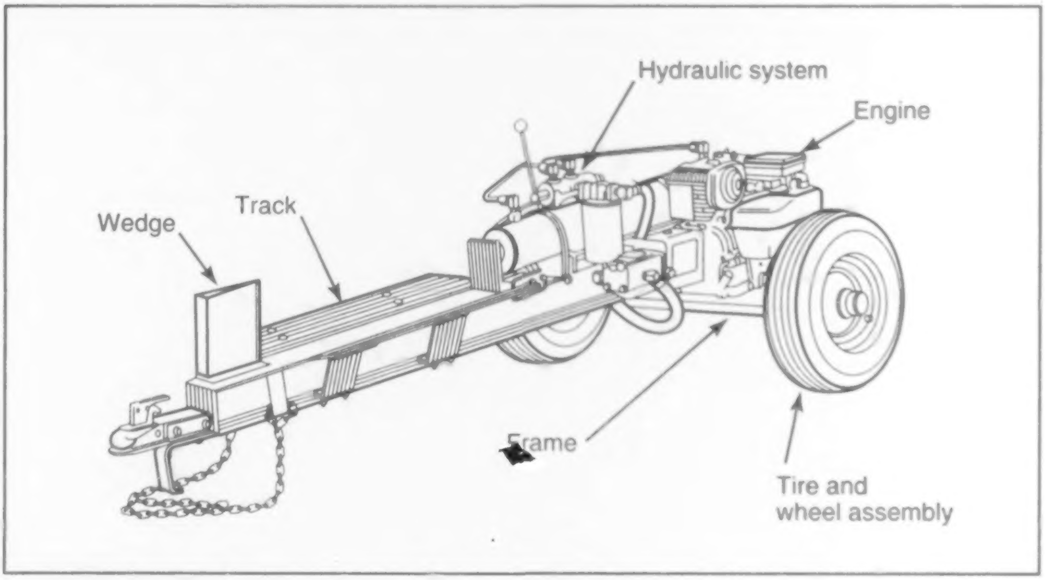
  Note: Tines become bent and worn during use. Repair of badly damaged tines is not practical. Although it is possible to repair some defects—such as welding a sleeve to a worn hub hole—repairs are often not cost effective. Further, while tines have a tapered leading edge, there is generally no need to sharpen them.

- Service chassis and frame

13. Major components of log splitters and their functions (see Figure 5)

Note: Log splitters are used to split logs. Splitting large-diameter logs makes the logs easier to transport and stack, better able to fit into stoves and fireplaces, and easier to burn. The natural growth of a tree causes it to have layers or rings that extend vertically through the tree. When the tree is cut and the wood has dried or cured, the rings and the fibers that compose them begin to separate. If a wedge is driven into the end of a cured log, the pressure exerted laterally against the wood increases as the taper of the wedge widens. This is how an ax splits wood, and it is the same principle that allows the hydraulically driven wedge of a log splitter to split logs.

Figure 5: Major components of log splitters



- **Frame**—Supports the engine and the equipment drive

  Note: The frames of many log splitters are built as trailers so that the log splitter can be easily towed. In some designs the frame is designed so that it can be tilted to a vertical position for operation of the splitter.

Information Sheet

- **Wedge**—Separates the fibers of the log

  Note: In the two major design variations, a log splitter may have a movable wedge or a fixed wedge. In the movable-wedge design, the wedge is driven down a track by a hydraulic ram. The opposite end of the track is formed into a cradle to hold a log. The track carries the wedge into the end of the log, causing the log to split. In the fixed-wedge design, the log is pushed by the ram into the wedge.

- **Track**—Guides the travel of the log or wedge

  Note: The wedge or log travels down the track with a great deal of force. Although the wedge is not overly sharp, there is enough force to sever fingers and crush bones if they are caught between the wedge and an object. The track or log cradle and other parts of the log splitter normally display warnings about the dangers of operating the equipment. Technicians should read and follow these warnings and all other safety practices contained in the operator's manual.

- **Engine**—Provides the power to build the hydraulic pressure

  Note: The main purpose of the engine in a log splitter is to develop pressure in the hydraulic system by powering the hydraulic pump.

- **Hydraulic system**—Provides the hydraulic power to drive the wedge or log

  Note: The operator uses a lever that controls a valve that applies pressure to the hydraulic piston. When the pressure is applied to one side, the ram drives the wedge or log down the track to split the log. Hydraulic pressure on the other side of the piston retracts the wedge or the ram after the log has been split.

- **Tire and wheel assemblies**—Support the equipment and make it easier to move

14. Operating feature used to classify log splitters

- **Wedge/ram configuration——movable wedge/ram pushes the wedge into the log or fixed wedge/ram pushes the log into the wedge**

  Note: While log splitters differ greatly in the size of engines, details of hydraulic-system design, log capacity, splitting strength, and other specifications, there are only the two major variations stated above. Some log splitters allow the wedge to be operated either vertically or horizontally by rotating the ram, but the operation of the equipment is basically the same.

15. Principles of operation of log splitters

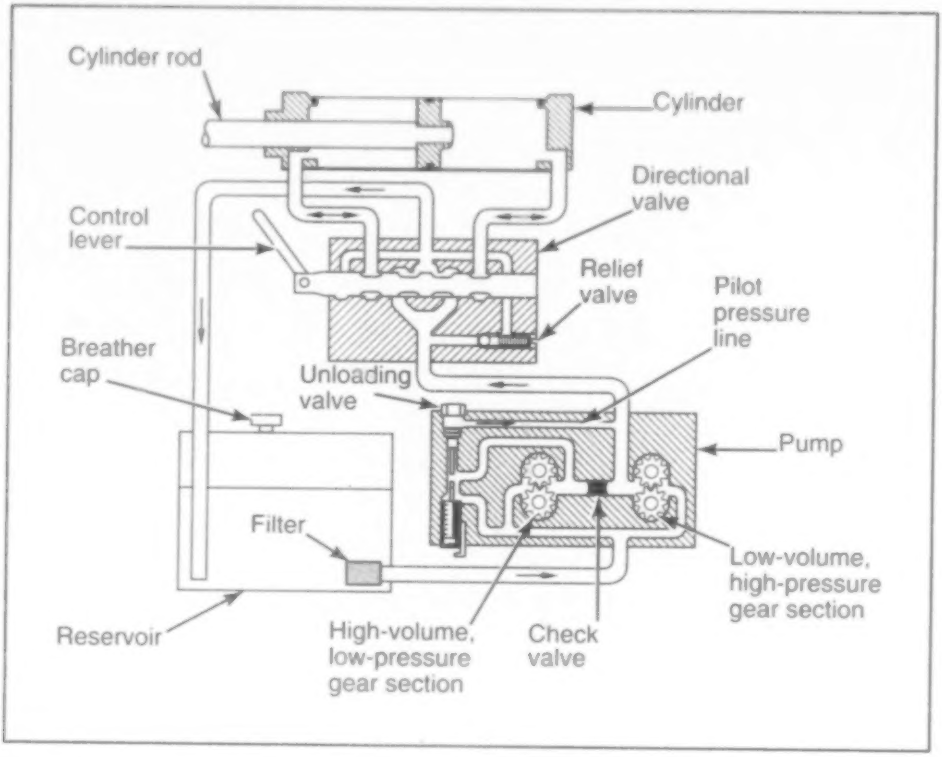
- The engine provides the power to drive the hydraulic system.

- When the actuating lever is in the neutral position, the pump of the hydraulic system moves fluid through the system so that fluid flows from the reservoir, through the pump, through the directional valve, and back to the reservoir.

  Note: Many log-splitter pump units, such as the one shown in Figure 6 on the next page, contain two pumps. One pump normally circulates fluid through the system, while the output of both pumps is used to build system pressure faster.

Information Sheet

Figure 6: Typical log-splitter hydraulic system


Cylinder rod
Cylinder
Directional valve
Control lever
Relief valve
Pilot pressure line
Breather cap
Unloading valve
Pump
Filter
Low-volume, high-pressure gear section
Reservoir
High-volume, low-pressure gear section
Check valve

- Fluid pressure builds until it reaches a preset level called the *unloading pressure*, at which point all or part of the fluid is diverted back to the reservoir.

  Note: In the system shown in Figure 6, a pilot line is connected to an unloading valve. A pilot line is a hydraulic or pneumatic line that supplies system pressure to a valve in order to open or close the valve or change its directional setting. In this case, when the system reaches unloading pressure, fluid in the pilot line opens the unloading valve so that fluid from the high-volume pump circulates back to the inlet side of the pump. This reduction in pressure causes the check valve to close off the pump's outlet to the directional valve so that all its fluid is recirculated.

- When the actuator lever is in the forward position, fluid pressure is applied to the back side of the ram piston, causing it move forward with a great deal of force.

  Note: Log splitters typically produce 10 to 50 tons of force.

- The movement of the piston pushes the wedge down the rail and into the log or pushes the log into the wedge.

- When the ram is fully extended, a relief valve opens so that pump pressure is diverted to the reservoir.

  Note: If for some reason the pressure continues to build, such as a clogged line preventing fluid from flowing back to the reservoir, the valve vents fluid outside the system to prevent component damage.

- When the actuating lever is in the reverse position, pressure is applied to the other side of the piston to move it back in the cylinder.

  Note: The amount of time required for the piston to move the ram for one splitting operation, return to its neutral position, and have enough pressure build for another splitting operation is called *cycle time*. The greater the output of the hydraulic pump, the shorter the cycle time. Cycle times are typically 15 to 30 seconds.

16. **Typical service procedures required for log splitters**

- Service engine
- Service hydraulic system
- Adjust or replace splitting wedge

  Note: The splitting wedge wears with use. Many log splitters have an adjustment mechanism or procedure that allows the wedge to be positioned to adjust the distance between the wedge plate and the beam.

- Service starting system

  Note: Most log splitters use rope-pull recoil starters.

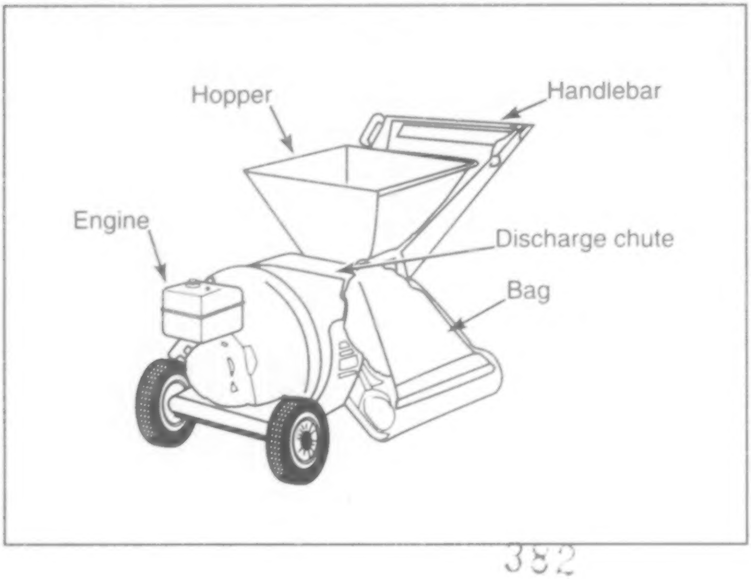
- Service tire and wheel assembly

  Note: Many log splitters have frames that are designed to be used as trailers. Therefore, they have rugged tire and wheel assemblies that include pneumatic tires and wheel bearings.

- Service frame

17. **Major components of shredders and their functions** (see Figure 7)

Figure 7: Major components of shredders



Information Sheet

- **Engine**—Provides the power to drive the cutting blades
- **Hopper**—Allows the operator to feed limbs, leaves, and other material into the shredder from above
- **Handlebar**—Allows the operator to guide the shredder to relocate the equipment
- **Cutting blades**—Rotate to cut the material and to drive it through the shear blades

  Note: Most shredders have two or three rotating blades. Some have separate cutting and chipping blades.

- **Shear plates**—Provide further cutting and reduction of the shredded material as the cutting blades push the material through them
- **Discharge chute**—Allows the shredded material to exit the equipment

  Note: Shredders often accommodate bags (see Figure 7 on the previous page) that can be installed on the discharge chute. Many also allow the debris to be discharged into the air, which allows the operator to spread a mulch over a lawn, garden, or flower bed but results in an increased risk to the operator from flying debris.

18. Types of shredders and their descriptions

- **Compost grinder**—Uses an engine generally of less than 4 horsepower to grind leaves, grass cuttings, and similar light materials, and usually discharges the mulch onto the ground
- **Shredder/bagger**—Uses an engine in the 4- to 8-horsepower range to grind leaves, branches, and other materials, and usually accommodates a bag into which the mulch is discharged

  Note: Bag systems may use either a reusable vented bag that must be emptied—similar to those used on lawn mowers—or disposable bags that are removed and replaced once full.

- **Chipper**—Uses an engine generally of 8 or more horsepower to grind leaves, branches, and small limbs, and usually discharges the mulch onto the ground or into a wagon

19. Principles of operation of shredders

- The engine powers two or more rotary cutting blades.
- Debris is deposited into an intake chute or hopper.

  Note: Some models can be reconfigured so that the intake is positioned as a leaf ramp on the ground where leaves can be raked or swept into the shredder.

- The rotation of the cutting blades forces the debris between shear plates; this action cuts the debris into fine particles.
- The rotation of the blades also creates a draft that pulls the debris into the cutting section and forces it out the discharge chute.

20. Typical service procedures required for shredders

- Service engine
- Sharpen blade
- Service equipment drive
- Service chassis

Heavy-Duty Lawn and Garden Equipment
Unit 3

Job Sheet 1—Perform Routine Maintenance on Garden Tractors and Riding Lawn Mowers

Introduction

This job sheet covers the routine maintenance associated with garden tractors and riding lawn mowers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Service engine, including related systems (fuel, lubrication, air filters, etc.)
- Service drive train, including adjusting belts and chains, lubricating chains, and maintaining transmission fluid levels
- Service equipment drive
- Level mower deck
- Service chassis, steering, and brake systems
- Service chassis electrical system

Procedure

1. Study all of the objectives in the information sheet.

2. Watch your instructor's demonstration of performing routine maintenance on garden tractors and riding lawn mowers and any supporting media provided by your instructor.

3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one garden tractor or riding lawn mower. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.

4. Ask your instructor to provide you with a garden tractor or riding lawn mower.

5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.

6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.

7. Using the instructor-approved service information and equipment/materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 1

Worksheet—Perform Routine Maintenance on Garden Tractors and Riding Lawn Mowers

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 1

Worksheet—Perform Routine Maintenance on Garden Tractors and Riding Lawn Mowers

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Part B: **Performance evaluation**

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	
Procedures completed correctly.	
Proper tools used correctly.	
Safety precautions observed.	
Service meets specifications.	
Clean-up and follow-up actions adequate.	
Overall rating	

Evaluator's comments

Heavy-Duty Lawn and Garden Equipment
Unit 3

Job Sheet 2—Repair Garden Tractors and Riding Lawn Mowers

Introduction

This job sheet covers the repair procedures associated with garden tractors and riding lawn mowers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Replace system components, including engine, transmission, gears, belts, U-joints, etc.
- Overhaul engine or drive train
- Perform adjustments to return equipment to original specifications

Procedure

1. Study all of the objectives in the information sheet.

2. Watch your instructor's demonstration of repairing garden tractors and riding lawn mowers and any supporting media provided by your instructor.

3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one garden tractor or riding lawn mower. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.

4. Ask your instructor to provide you with a garden tractor or riding lawn mower that requires repair.

5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.

6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.

7. Using the instructor-approved service information and equipment/ materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 2

Worksheet—Repair Garden Tractors and Riding Lawn Mowers

Name Attempt number

Date

Part A: Pre-performance check

Job

- Complete the following information concerning the assigned equipment.

  Equipment brand

  Equipment model/type and code

- Complete the following service-manual information.

  Service-manual title

  Section/page number of procedure

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature

Job Sheet 2

Worksheet—Repair Garden Tractors and Riding Lawn Mowers

Part B: **Performance evaluation**

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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Heavy-Duty Lawn and Garden Equipment
Unit 3

Job Sheet 3—Perform Routine Maintenance on Tillers

Introduction

This job sheet covers the routine maintenance associated with tillers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Service engine
- Inspect components
- Lubricate gears, chains, and linkages
- Adjust belt tension
- Align pulleys and sprockets
- Adjust actuating linkage

Procedure

1. Study all of the objectives in the information sheet.

2. Watch your instructor's demonstration of performing routine maintenance on tillers and any supporting media provided by your instructor.

3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one tiller. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.

4. Ask your instructor to provide you with a tiller.

5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.

6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.

7. Using the instructor-approved service information and equipment/materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 3

Worksheet—Perform Routine Maintenance on Tillers

Name ______________________________ Attempt number __________

Date ______________________________

Part A: Pre-performance check

Job ______________________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________________

  Equipment model/type and code ______________________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________________

  Section/page number of procedure ______________________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________________

Job Sheet 3

Worksheet—Perform Routine Maintenance on Tillers

Part B: **Performance evaluation**

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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Heavy-Duty Lawn and Garden Equipment
Unit 3

Job Sheet 4—Repair Tillers

Introduction

This job sheet covers the repair procedures associated with tillers. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Replace components, including gears, belts, tines, etc.
- Overhaul engine or drive train
- Perform adjustments to return equipment to original specifications

Procedure

1. Study all of the objectives in the information sheet.

2. Watch your instructor's demonstration of repairing tillers and any supporting media provided by your instructor.

3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one tiller. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.

4. Ask your instructor to provide you with a tiller that requires repair.

5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.

6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.

7. Using the instructor-approved service information and equipment/ materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 4

Worksheet—Repair Tillers

Name ______________________________ Attempt number __________

Date ______________________________

Part A: **Pre-performance check**

Job ______________________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________________

  Equipment model/type and code ______________________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________________

  Section/page number of procedure ______________________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________________

Job Sheet 4

Worksheet—Repair Tillers

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	________
Procedures completed correctly.	________
Proper tools used correctly.	________
Safety precautions observed.	________
Service meets specifications.	________
Clean-up and follow-up actions adequate.	________
Overall rating	________

Evaluator's comments ____

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Heavy-Duty Lawn and Garden Equipment
Unit 3

Job Sheet 5—Perform Routine Maintenance on Log Splitters

Introduction This job sheet covers the routine maintenance associated with log splitters. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Inspect components
- Service engine
- Lubricate gears, chains, and rams
- Adjust belt tension
- Align pulleys and shafts
- Maintain fluid levels
- Inspect and replace hydraulic filters

Procedure

1. Study all of the objectives in the information sheet.

2. Watch your instructor's demonstration of performing routine maintenance on log splitters and any supporting media provided by your instructor.

3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one log splitter. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.

4. Ask your instructor to provide you with a log splitter.

5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.

6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.

7. Using the instructor-approved service information and equipment/materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 5

Worksheet—Perform Routine Maintenance on Log Splitters

Name ____________________ Attempt number ________

Date ____________________

Part A: Pre-performance check

Job ____________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ____________________

  Equipment model/type and code ____________________

  ____

- Complete the following service-manual information.

  Service-manual title ____________________

  Section/page number of procedure ____________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ____________________

Job Sheet 5

Worksheet—Perform Routine Maintenance on Log Splitters

Part B: Performance evaluation

Evaluation criteria **Rating**

Correct procedures identified for assigned equipment. ______

Procedures completed correctly. ______

Proper tools used correctly. ______

Safety precautions observed. ______

Service meets specifications. ______

Clean-up and follow-up actions adequate. ______

Overall rating ______

Evaluator's comments ____

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Heavy-Duty Lawn and Garden Equipment
Unit 3

Job Sheet 6—Repair Log Splitters

Introduction

This job sheet covers the repair procedures associated with log splitters. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Replace components, including gears, belts, seals, etc.
- Overhaul engine
- Overhaul hydraulic system
- Perform adjustments to return equipment to original specifications

Procedure

1. Study all of the objectives in the information sheet.
2. Watch your instructor's demonstration of repairing log splitters and any supporting media provided by your instructor.
3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one log splitter. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.
4. Ask your instructor to provide you with a log splitter that requires repair.
5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.
6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.
7. Using the instructor-approved service information and equipment/materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 6

Worksheet—Repair Log Splitters

Name ______________________ Attempt number ________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 6

Worksheet—Repair Log Splitters

Part B: **Performance evaluation**

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	________
Procedures completed correctly.	________
Proper tools used correctly.	________
Safety precautions observed.	________
Service meets specifications.	________
Clean-up and follow-up actions adequate.	________
Overall rating	________

Evaluator's comments ____

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Heavy-Duty Lawn and Garden Equipment
Unit 3

Job Sheet 7—Perform Routine Maintenance on Shredders

Introduction

This job sheet covers the routine maintenance associated with shredders. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Inspect components
- Lubricate gears, chains, bearings, and linkages
- Adjust belt tension
- Align pulleys and shafts
- Inspect rotating and shear blades
- Clear discharge chute

Procedure

1. Study all of the objectives in the information sheet.
2. Watch your instructor's demonstration of performing routine maintenance on shredders and any supporting media provided by your instructor.
3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one shredder. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.
4. Ask your instructor to provide you with a shredder.
5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.
6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.
7. Using the instructor-approved service information and equipment/materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 7

Worksheet—Perform Routine Maintenance on Shredders

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 7

Worksheet—Perform Routine Maintenance on Shredders

Part B: **Performance evaluation**

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	_____
Procedures completed correctly.	_____
Proper tools used correctly.	_____
Safety precautions observed.	_____
Service meets specifications.	_____
Clean-up and follow-up actions adequate.	_____
Overall rating	_____

Evaluator's comments ______________________________

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____

Heavy-Duty Lawn and Garden Equipment
Unit 3

Job Sheet 8—Repair Shredders

Introduction

This job sheet covers the repair procedures associated with shredders. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Replace components, including gears, belts, blades, bearings, etc.
- Overhaul engine
- Overhaul equipment-drive system
- Perform adjustments to return equipment to original specifications

Procedure

1. Study all of the objectives in the information sheet.
2. Watch your instructor's demonstration of repairing shredders and any supporting media provided by your instructor.
3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one shredder. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.
4. Ask your instructor to provide you with a shredder.
5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.
6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.
7. Using the instructor-approved service information and equipment/materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 8

Worksheet—Repair Shredders

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 8

Worksheet—Repair Shredders

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

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Chain Saws
Unit 4

Objective Sheet

Unit objective

After completing this unit, the student should be able to describe the design and operation of common chain saws and be able to perform routine maintenance and service procedures on chain saws. The student should demonstrate these competencies by completing the assignment sheets and job sheets and by scoring a minimum of 85 percent on the written test.

Specific objectives

After completing this unit, the student should be able to

1. State the functions of the major components of chain saws.
2. Complete statements about the principles of operation of chain saws.
3. State the functions of the major components of chains.
4. Match the parts of cutters to their correct definitions.
5. Describe types of cutters.
6. State the functions of the major components of guide-bar assemblies.
7. Label types of guide bars.
8. List types of chain oilers.
9. Complete statements about the principles of operation of pulsation-pump chain oilers.
10. Complete statements about the principles of operation of cam-operated-pump chain oilers.
11. Complete statements about the principles of operation of gear-driven-pump chain oilers.
12. Define types of chain drives.
13. List types of drive sprockets.
14. Define types of hazards associated with chain-saw operation.
15. State safety rules for servicing chain saws.
16. List the protective equipment to be worn during chain-saw service.
17. State the functions of the specialty tools used in chain-saw service.
18. List typical service procedures required for chain saws.
19. Calculate fuel-mix ratios. (Assignment Sheet 1)

Objective Sheet

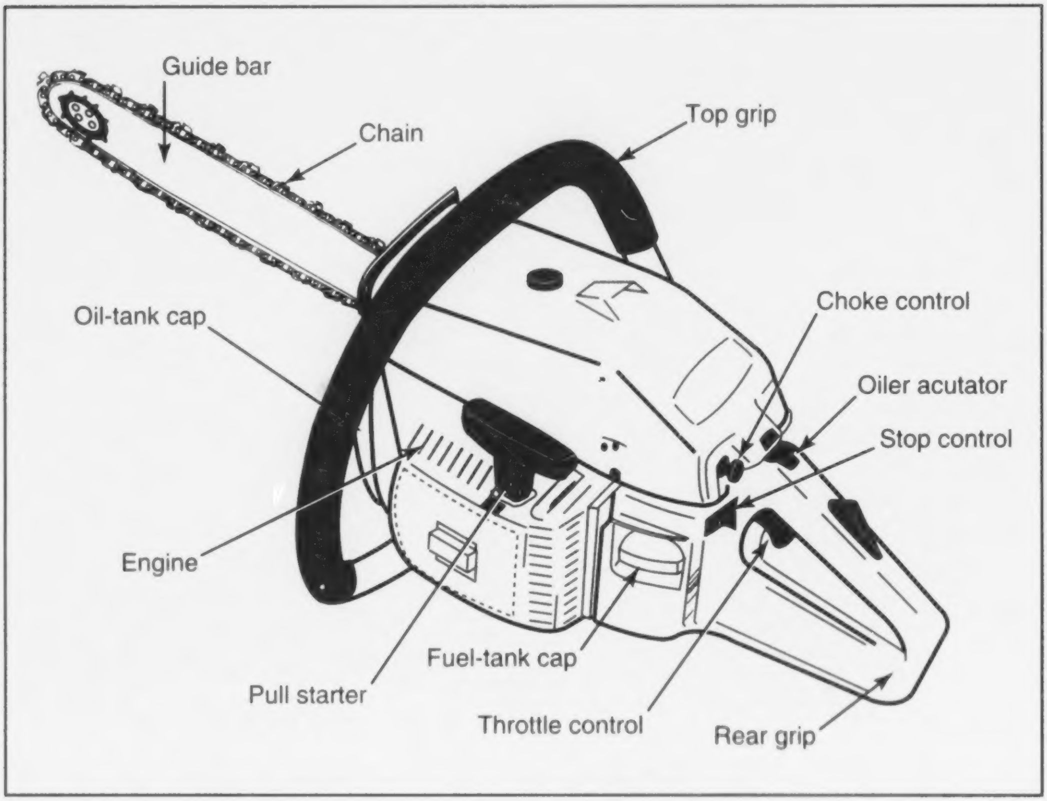
20. Calculate chain pitch. (Assignment Sheet 2)
21. Determine chain-saw service specifications and parts requirements. (Assignment Sheet 3)
22. Troubleshoot poor performance in chain saws. (Assignment Sheet 4)
23. Perform routine maintenance on chain saws. (Job Sheet 1)
24. Repair chain saws. (Job Sheet 2)

Chain Saws
Unit 4

Information Sheet

1. **Major components of chain saws and their functions** (see Figure 1)

Figure 1: Major components of chain saws


Guide bar
Chain
Top grip
Oil-tank cap
Choke control
Oiler acutator
Stop control
Engine
Fuel-tank cap
Pull starter
Throttle control
Rear grip

- **Rear grip**—Allows the operator to hold the saw and to actuate the throttle control

  Note: The rear grip is often also referred to as the *rear handle* or *control handle*.

- **Pull starter**—Turns the engine flywheel to start the internal-combustion process

- **Fuel-tank cap**—Provides access to the tank in which the fuel is stored to operate the engine

- **Top grip**—Provides the operator with a second handhold to provide better control of the saw

  Note: The top grip is approximately at a balance point of the saw so that the operator can swivel the saw left and right and pivot it up and down easily. Many saws have a shield in front of the top grip for additional protection. The top grip is also referred to as the *front grip*, *top* or *front handle*, or *handlebar*.

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- **Oiler actuator**—Allows the operator to lubricate the chain manually

  Note: In order to reduce friction and to cool the guide bar and chain, oil is dispensed onto the guide bar, generally near where the chain exits the chain-saw housing. The oiler system consists of a tank to hold the oil and a pump to move oil from the tank through a line to the bar. A chain saw may have an automatic oiler, a manual oiler, or a system that uses both forms of actuation. Manual actuation is generally accomplished by the use of a button or switch located near the throttle control, such as that shown in Figure 1 on the previous page.

- **Oil-tank cap**—Provides access to the tank from which oil is dispensed to lubricate the moving chain

  Note: The oil tank is generally located in the top-front portion of the housing, with the cap on top and the pump mechanism located near the bottom of the oil tank. The operator must refill the oil tank periodically, whether the oiler is automatic or manual. Pump mechanisms are explained in more detail in Objectives 8 through 11.

- **Chain**—Cuts wood

  Note: Chains for common chain saws—other than those used by the forestry industry—are pretty much the same except for the cutters. Cutters differ in the type of cutting edge, depth gauge, and other features for specific applications. See Objectives 3 through 5, where chains are discussed in more detail.

- **Guide bar**—Provides the track in which the chain travels

  Note: The guide bar is the flat metal part that protrudes from the chain saw. It contains a groove (race) that runs along its edge to guide the travel of the chain. The guide bar is normally attached to the chain saw with a slotted bolt hole so that it can be moved in or out of the housing to adjust the amount of tension on the chain. Various types of guide bars are used for specific cutting operations. See Objective 7, where guide bars are discussed in more detail.

- **Chain-tension adjuster**—Tightens or loosens the chain

  Note: As chains operate, they stretch due to heat and due to metal fatigue. For this reason, chain saws provide a means of moving the end of the guide bar out from the saw body to take up the slack in the chain, often a screw that is turned in or out to move the guide bar. The operator loosens the guide-bar mounting bolts, turns the chain-tension adjuster to provide the desired amount of slack, and then re-tightens the mounting bolts. Most manufacturers recommend that the chain tension be maintained with a little slack in the chain so that the center link hooks hang just clear of the guide-bar rails at the midpoint of the bottom of the guide bar. This amount of slack allows the engine to drive the chain without slipping while at the same time preventing excessive wear. The adjustment is generally made by turning a screw that is linked to the guide bar in such a way that the guide bar moves out as the screw is tightened.

- **Clutch**—Engages or disengages the chain drive sprocket

  Note: Most chain saws use centrifugal clutches. The engine crankshaft extends into the clutch mechanism, which includes friction shoes mounted to the end of the shaft inside a drum. As engine speed increases, centrifugal force causes the shoes to expand against their retaining springs until they engage the drum. In this way, rotary motion is transferred to the drum, which has a sprocket built into its outer surface. The sprocket engages the chain so that rotation of the drum drives the chain around the guide bar.

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- **Engine**—Provides the power to drive the chain

  Note: Most chain saws use single-cylinder, two-stroke-cycle engines. Some engines have two opposed cylinders. The carburetors typically have integrated-diaphragm pumps driven by the vacuum differential of the crankcase. This design is preferable to gravity-feed carburetors as chain saws are required to operate through a wide range of orientations. Some carburetors have a second integrated pump—often called an *accelerator pump*. The accelerator pump stores a small amount of fuel that is automatically injected into the carburetor in the event of inadequate fuel due to low vacuum.

- **Throttle control**—Regulates the flow of fuel to the air/fuel mixture

  Note: The throttle control is generally a trigger-type switch built into the rear grip. Many chain saws offer a safety device that prevents the throttle control from moving unless a second switch is also actuated. In this way, the engine cannot accidentally be accelerated enough to drive the chain.

- **Choke control**—Allows the operator to enrich the air/fuel mixture when starting a cold engine

  Note: An engine that is not warm generally requires a richer fuel mixture to start than one that has been running. Most chain-saw starting procedures specify that the choke valve should be closed when starting the engine cold and left closed until the engine tries to start, at which time the choke valve is opened.

- **Stop control**—Allows the operator to stop the engine when it is operating

  Note: Sometimes called a *start/stop switch*, the stop control routes electricity to ground to prevent ignition or opens the ground circuit to allow ignition. With the switch in the *on* or *run* position, the ground circuit is open, allowing ignition to take place. In the *stop* position, the ground circuit is closed so that normal ignition cannot take place.

2. **Principles of operation of chain saws**

- A pull-recoil starter is used to start the engine.

  Note: A properly adjusted chain-saw carburetor idles at a low enough speed that the centrifugal clutch does not engage.

- When the operator squeezes the throttle control, the engine speed increases; when the engine speed is great enough, the clutch engages the drive sprocket and causes it to rotate.

- The rotation of the drive sprocket drives the chain, which travels in a continuous loop around the guide bar.

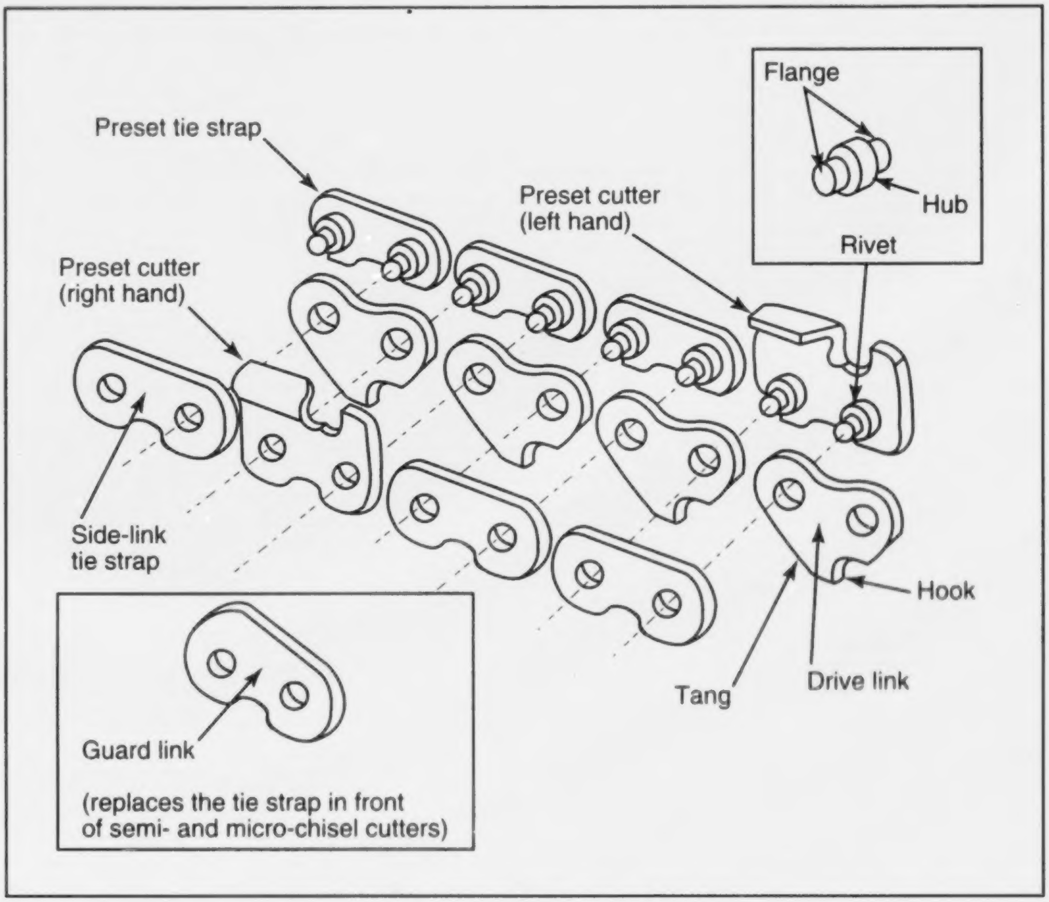
- The cutters on the chain cut wood by slicing under a section of wood and breaking off the chip that is formed.

- Oil is manually or automatically dispensed onto the chain as it exits the housing to lubricate the chain and bar as the chain goes around the guide bar.

- When the throttle control is released, the engine speed drops to the point that the clutch disengages from the drive sprocket.

3. Major components of chains and their functions

Figure 2: Components of chains


Flange
Hub
Rivet
Preset tie strap
Preset cutter (left hand)
Preset cutter (right hand)
Side-link tie strap
Hook
Tang
Drive link
Guard link
(replaces the tie strap in front of semi- and micro-chisel cutters)

- **Side-link tie strap**—Connects the drive links and cutters

  Note: The length of the tie strap determines one important characteristic of the chain called *pitch*. Pitch is the distance between the centers of corresponding rivets. Pitch typically ranges between ¼ and ½ inch at set intervals. Pitch must match the spacing of the drive sprocket.

- **Preset tie strap**—Connects the drive links and cutters and has rivets to attach to the other components

  Note: There are three general types of tie straps. The typical side-link tie strap joins two drive links and, along with the cutters, forms the one outside band of the chain. The other outside band consists of preset tie straps. These are like the tie straps on the other side of the chain but differ in that they have rivets installed in them. The third type of side link is called a *guard link*. A guard link replaces the tie strap in front of semi- and micro-chisel cutters. Guard links have raised topsides in order to protect the thin edges of these cutter designs by preventing them from contacting obstacles above and in front of the guide bar.

- **Drive link**—Meshes with the sprocket teeth to drive the chain around the guide bar

  Note: The drive link has an extended tang that rides in the groove of the guide bar. The tang has a curved portion called a *hook* that engages the drive sprocket. Some drive links also have a raised topside called a *kickback guard* or *antikickback drive link*. It prevents the cutters from striking objects at the end of the guide bar. One danger of this situation is called *kickback* in which the sudden extended cut of the cutter at the nose of the guide bar almost stops the chain, which can be dangerous to the operator who can be thrown forward by the sudden jolt. A second important dimension of a chain-saw chain is called *gauge* (gage). Gauge is the thickness of the tang of the drive links. Common gauge sizes are 0.050, 0.058, and 0.063 inch. Gauge is obviously important to ensure proper fit of the chain in the guide-bar groove.

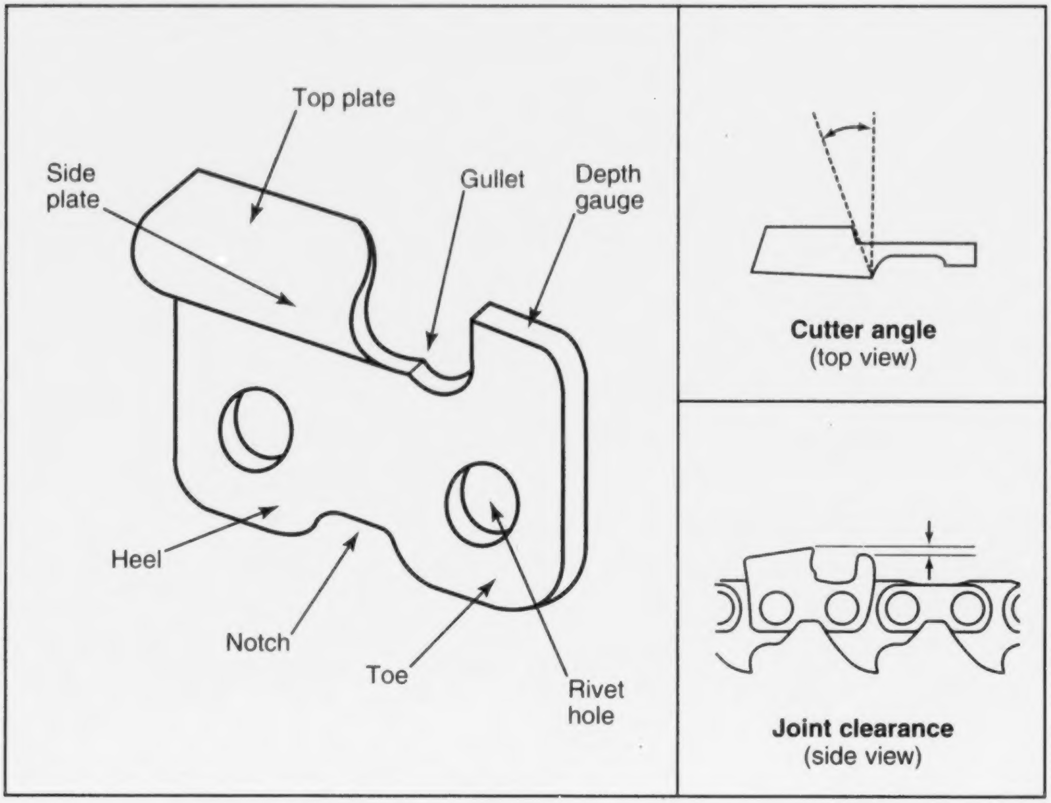
- **Preset cutter**—Contains the cutting edge

- **Rivet**—Fastens the other components together

  Note: Rivets consist of three parts: the hub and two flanges (see Figure 2). The holes of the drive links rest on the hub of the rivets and rotate about them as the chain goes around the guide bar. The flanges extend through the holes of the tie straps and preset tie straps. The ends of the flanges are compressed to hold the chain components together.

4. **Parts of cutters and their definitions** (see Figure 3)

Figure 3: Parts of cutters



Cutter angle
(top view)

Joint clearance
(side view)

Information Sheet

- **Depth gauge**—Leading edge of the cutter that allows the cutting edge to enter to a desired depth into the surface being cut

  Note: The cutting edge digs into the wood being cut until the depth gauge makes contact with the wood and, thus, limits the depth of the cut. The depth gauge is sometimes also referred to as a *rider* because it rides on the surface being cut.

- **Joint clearance**—Distance between the top of the cutter and the top of the depth gauge

  Note: Also called the *depth-gauge clearance*, the joint-clearance distance is limited by the depth gauge.

- **Cutter angle**—Angle of the cutting edge as compared to the centerline of the chain length

  Note: The alignment of the cutter to the surface being cut is critical to efficient sawing and to avoid excessive load on the engine; stress on chain-saw components; and wear of the chain, guide bar, and sprocket. Consequently, the cutting-edge structure consists of a number of angles, including the cutter angle (see Student Supplement 1). The optimum cutter angle (cutting-edge angle) is 30 to 35 degrees for a chipper and 20 degrees for a chisel cutter.

- **Side plate**—Vertical portion of the cutting-edge structure

- **Top plate**—Horizontal portion of the cutting-edge structure

- **Gullet**—Recessed area between the cutting-edge structure and the depth gauge

- **Rivet hole**—Drilled hole through which the rivet flange is inserted

- **Toe**—Leading portion of the cutter body

- **Heel**—Trailing portion of the cutter body

- **Notch**—Recessed area in the edge of the cutter body between the heel and the toe

5. **Types of cutters and their descriptions**

- **Chipper** (see Figure 4-a on the next page)—General-purpose cutter that provides a medium depth of cut

- **Chisel** (see Figure 4-b on the next page)—Cutter that provides a shallow depth of cut for extremely hard woods

  Note: A chisel cutter is used with hard woods to avoid excessive loading of the chain-saw engine and excessive splitting of the wood grain.

- **Power sharp** (see Figure 4-c on the next page)—Cutter that provides a deep depth of cut for soft woods

  Note: A power-sharp cutter is used to reduce the cutting time required to cut a deep cut in soft wood.

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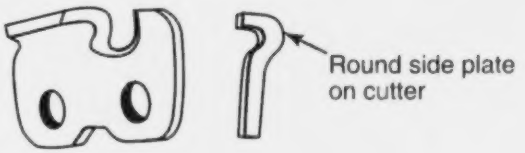
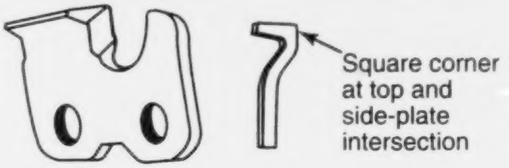
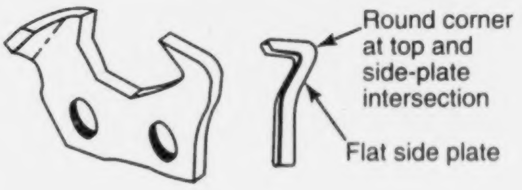
Figure 4: Types of cutters


Round side plate on cutter

a. **Chipper cutter**


Square corner at top and side-plate intersection

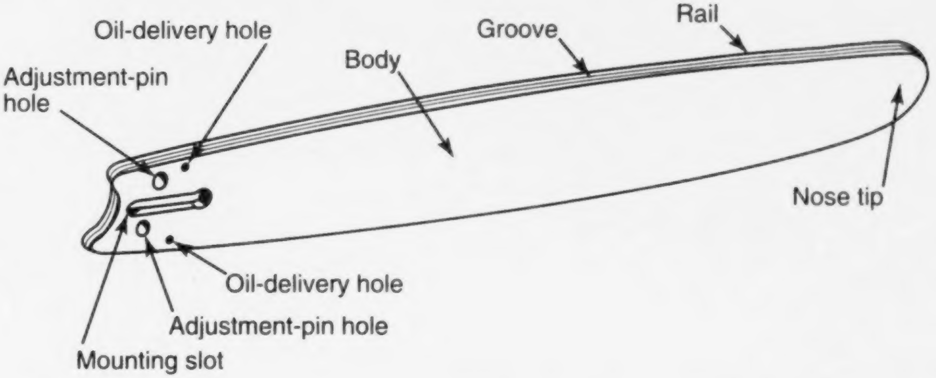
b. **Chisel cutter**


Round corner at top and side-plate intersection
Flat side plate

c. **Power-sharp cutter**

6. **Major components of guide-bar assemblies and their functions** (see Figure 5)

Figure 5: Components of guide-bar assemblies


Oil-delivery hole
Adjustment-pin hole
Body
Groove
Rail
Nose tip
Oil-delivery hole
Adjustment-pin hole
Mounting slot

Information Sheet

- **Body**—Provides the basic structure for the guide bar

- **Rails**—Form the groove and provide the surface on which the tie straps of the chain ride

- **Groove**—Guides the drive links around the guide bar

- **Nose tip**—Assists in changing the direction of travel of the chain at the end of the guide bar

  Note: There are two basic types of nose tips. Some guide bars provide a continuous groove along the nose of the bar and are referred to as *solid-nose guide bars*. Other designs include a sprocketed or grooved roller in the nose and are referred to as *roller-nose guide bars*. These designs help to reduce the friction of the chain as it reverses direction at the end of the guide bar. Even though chains are designed to operate with a slight amount of slack, most of that slack is in the underside of the chain, while the greatest amount of tension exists in the drive socket and nose tip. Roller-nose guide bars help to reduce the friction that this increased tension would otherwise produce.

- **Adjustment-pin holes**—Secure the adjusting pins to the guide bar

  Note: The actual number, arrangement, and design of adjustment-pin holes will depend on the type of adjusting mechanism. Most chain saws use one or more pins that fit into a hole or holes in the guide bar near the point where it is secured to the chain saw. Typically, a flange or pin extends into these holes, with the flange or pin mounted on an internally threaded body. An adjusting bolt passes through the threaded body, which is enclosed in a slot within which the threaded body can move. By rotating the adjusting bolt, the operator can move the threaded body in or out, which in turn changes the amount of guide bar that extends beyond the chain-saw housing and, thus, changes the amount of tension on the chain.

- **Oil-delivery holes**—Route lubricant from the oil tank to the groove to reduce friction along the drive-link path

  Note: Not all guide bars use oil-delivery holes, but all provide a means of lubricating the guide-bar groove.

- **Mounting slot**—Accommodates the hardware used to secure the guide bar to the chain saw and allows movement of the guide bar to adjust chain tension

7. **Types of guide bars**

   Note: Numerous guide-bar designs are used for various chain-saw applications. Some of the more popular are discussed in this objective. The primary differences in these designs are the general shape of the guide bar and the type of nose tip used. Nose tips can be classified as solid or roller and as fixed or replaceable. If a roller is used, it may be internal or external with regard to the bar. Each design has advantages and disadvantages with regard to specific applications.

   - **Shape of the guide bar**

     — **Standard** (see Figure 6-a on the next page)

     Note: The standard guide-bar shape has an evenly rounded nose. It may be fixed or replaceable and may have a solid or roller nose.

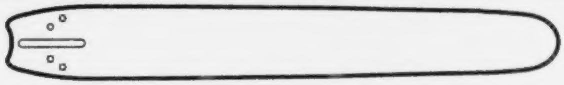
— **Banana** (see Figure 6-b)

Note: The banana-shaped guide bar has a slightly undercut nose tip. This design is intended to lessen the friction of the chain as it reverses direction at the nose tip. While banana guide bars do use replaceable tips, they are generally fixed. They may be solid or roller designs.

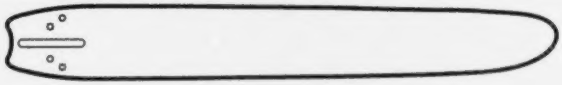
— **Bow** (see Figure 6-c)

Note: The bow-shaped guide bar is used to clear brush and to perform in other applications where light cutting can be done on more than one side of the bar at a time. Bow guide bars generally use solid, fixed construction.

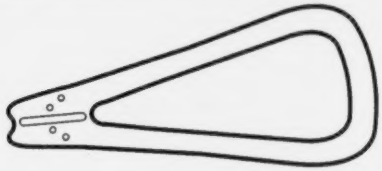
Figure 6: Guide-bar shapes



a. **Standard shape**



b. **Banana shape**



c. **Bow shape**

- **Type of nose tip**

— **Solid nose tip** (see Figure 7-a on the next page)

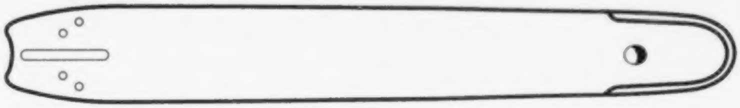
Note: Inexpensive and small chain saws intended for light use by consumers generally use solid-nose guide bars. Such guide bars are typically 12 inches or less in length.

— **External-roller nose tip** (see Figure 7-b on the next page)

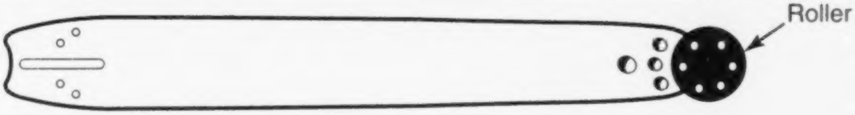
— **Internal-roller nose tip** (see Figure 7-c on the next page)

Note: There is little real difference in the functioning or performance of external- versus internal-roller nose bars. Physically, the body of the internal roller is contained in the body of the bar, while the external roller is mounted on the outside of the nose tip.

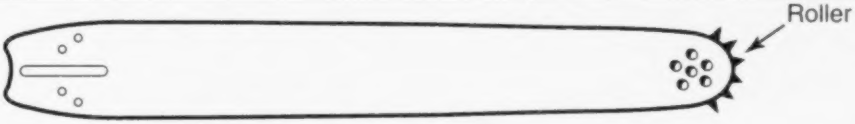
Figure 7: Nose-tip types



a. **Solid nose tip**



b. **External-roller nose tip**



c. **Internal-roller nose tip**

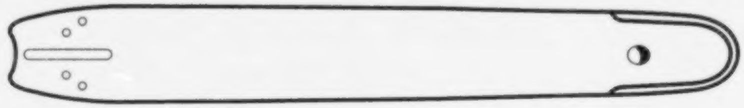
- **Replaceability of nose tip**
  - **Fixed, solid nose tip** (see Figure 6-a on page 167)
  - **Replaceable, solid nose tip** (see Figure 8-a on the next page)

    Note: Typically, the greatest amount of guide-bar wear occurs on the nose tip, even when the chain is properly adjusted and lubricated. For this reason, the operational life of a guide bar can be extended by using a replaceable nose tip. For solid-nose designs, the replaceable tip is generally an insert that can be slipped into a slot at the end of the guide-bar body and screwed or riveted into place. The insert is flared along its edges to form rails and a groove that replace a missing section of groove on the guide bar.

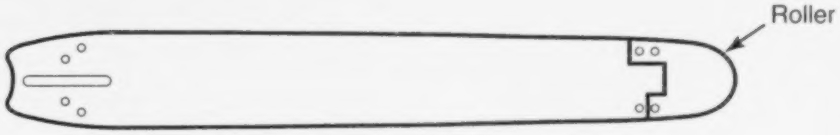
  - **Fixed, roller nose tip** (see Figure 7-b and Figure 7-c above)
  - **Replaceable, roller nose tip** (see Figure 8-b on the next page)

    Note: Figure 8-b shows a one-piece insert that contains an internal roller that can be installed on the end of a replaceable roller-nose guide bar. While in reality most nose-tip rollers can be replaced with the proper tools, fasteners, and replacement parts, the procedure is essentially an overhaul of the nose tip. The use of replaceable inserts provides the capability with a minimum number of parts and a relatively easy procedure.

Figure 8: Types of replaceable nose tips



a. **Replaceable, solid nose tip**



b. **Replaceable, roller nose tip**

8. Types of chain oilers

Note: The fast, friction-generating operation of a chain-saw chain in an exposed environment of dust, dirt, and debris makes good lubrication critical. To accomplish this, chain saws use oilers that inject oil onto the chain either directly or through the guide-bar groove, or by both methods. Injection is accomplished in one of two manners: manually by the operator or automatically whenever the engine is running.

- **Manual**

  Note: Many older chain saws use manual oilers that allow the operator to dispense oil by pushing a button or trigger. Actuation of the oiler generally pushes a plunger in the oil tank that pushes oil from the tank and onto the guide bar or chain. In some cases, the actuator operates a small pump—such as a diaphragm pump—to move oil from the tank to the discharge port.

- **Automatic**

  Note: Most modern chain saws provide automatic oilers. Generally, a cam or shaft is powered by the engine to pump oil from a tank continuously while the engine is operating. In this way, a thin trickle of oil is constantly provided to the chain, as long as the operator keeps the oil tank filled and the oil ports open. There are two primary methods used to transfer force from the engine to operate the pumps in automatic chain oilers: pneumatic and mechanical. Both types generally provide a means of adjusting the flow of oil—usually a metering screw. The most popular versions of pneumatic and mechanical pumps are discussed in Objectives 9 through 11. While pneumatic oilers—commonly called *pulsation-pump* oilers—are slightly less expensive and simpler, the primary reason for using one design over another is the manufacturer's preference.

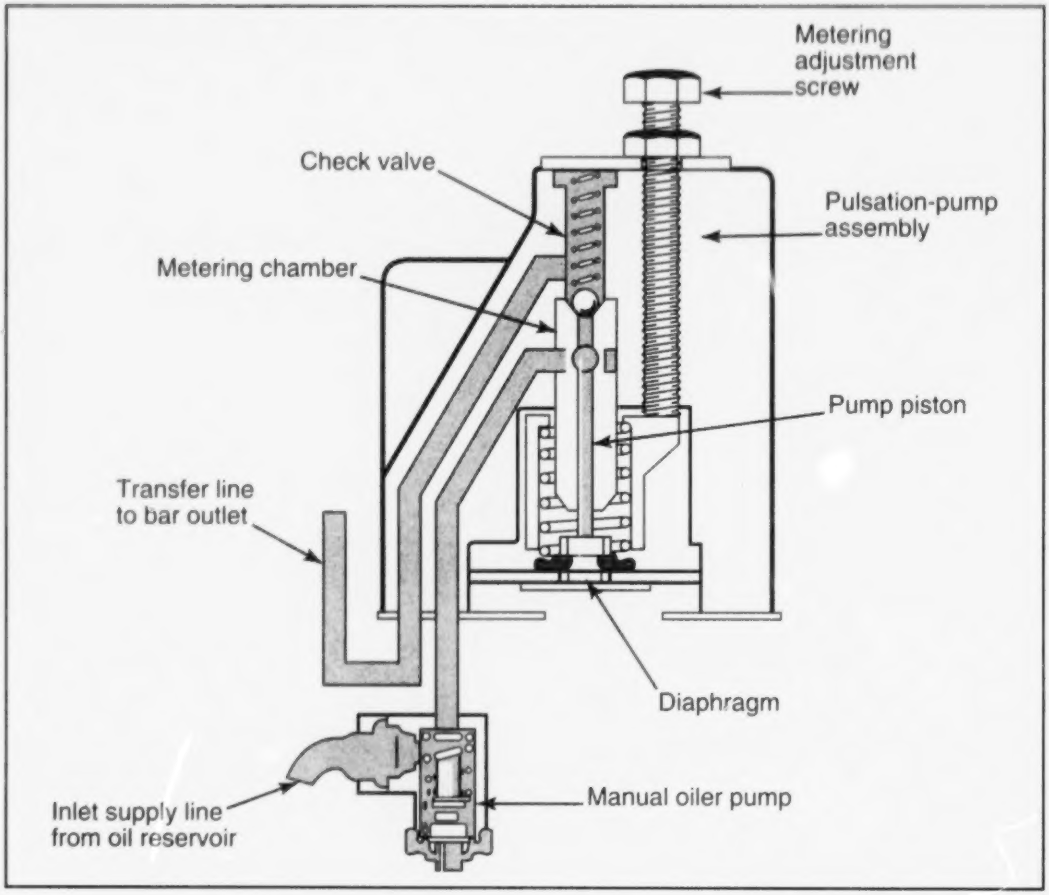
- **Combination automatic with manual**

  Note: Many chain saws—especially those intended for commercial or industrial use—feature both automatic and manual oiling. Automatic oiling uses an engine-driven system that provides a continuous supply of oil, while the operator also has the option of dispensing oil manually in the event that automatic oiling is inadequate. Inadequate oiling may be the result of cutting particularly tough wood or other materials, cutting in or around water or wet conditions, cutting in extremely dirty conditions or with the production of excessive debris, and under other conditions.

9. **Principles of operation of pulsation-pump chain oilers** (see Figure 9)

Note: The operation of the pulsation pump with its use of a flexible diaphragm is quite similar to the operation of a typical diaphragm fuel pump. The term *pulsation* identifies the fact that the pumping action is the result of the movement of the piston and the resulting changes in pressure within the crankcase.

Figure 9: Pulsation-pump chain oiler


Metering adjustment screw
Check valve
Pulsation-pump assembly
Metering chamber
Pump piston
Transfer line to bar outlet
Diaphragm
Manual oiler pump
Inlet supply line from oil reservoir

- The movement of the piston during compression creates low pressure in the crankcase.
- The chain-oiler diaphragm is vented to crankcase pressure on one side so that the diaphragm is pulled toward the crankcase when the pressure in the crankcase is low.

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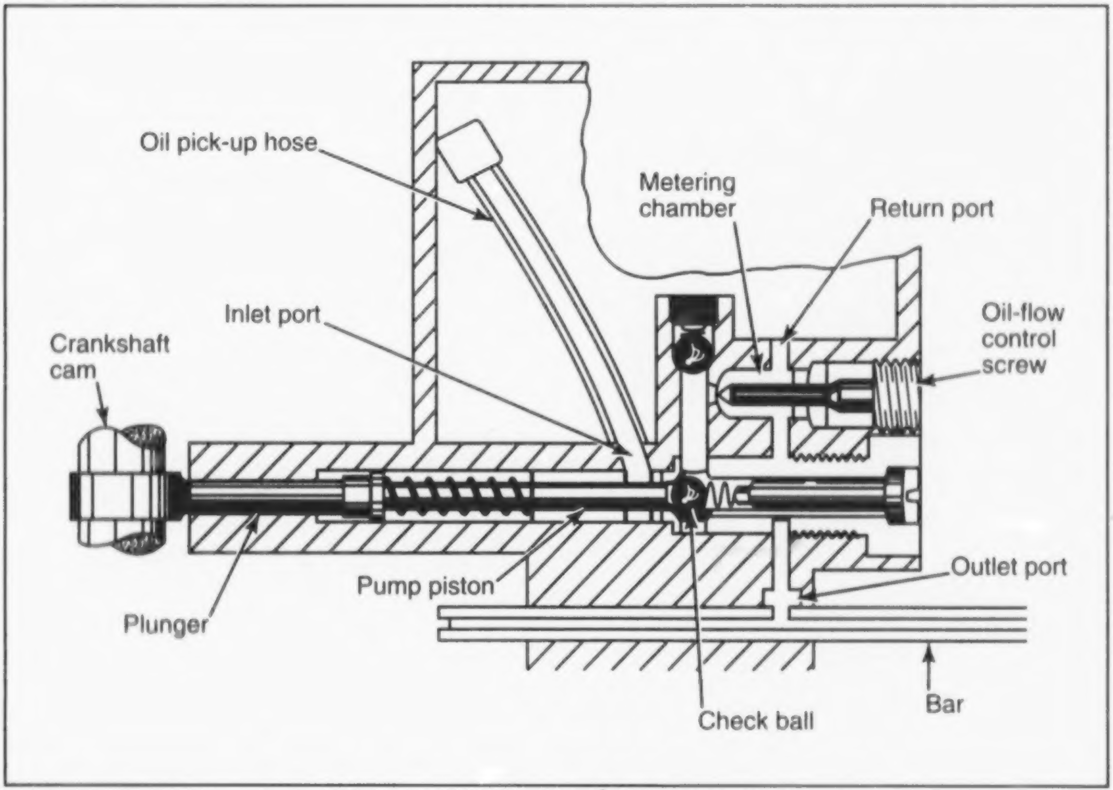
- The diaphragm is connected to the pump piston, which moves with the diaphragm; the movement of the piston toward the crankcase opens the oil-inlet port and draws oil from the tank into the metering chamber due to the decreasing pressure.

  Note: Remember, increasing the volume of a closed container results in lower pressure in the container, while decreasing the volume results in higher pressure. Thus, the volume of the crankcase expands as the piston moves toward the combustion chamber and decreases as the piston moves toward the crankcase. Similarly, as the oil-pump piston moves toward the crankcase, the volume of the metering chamber (pump cylinder) increases and the pressure in the chamber is lessened.

- As the crankcase pressure builds during the return stroke of the piston, the diaphragm is pushed away from the crankcase, causing the pump piston to return in its cylinder and to block the oil inlet.
- The continued return movement of the piston pressurizes the metering chamber, which overcomes the resistance of the check-valve spring so that the check valve moves off its seat.
- With the check valve open, the oil is forced past the valve and through the transfer line to the guide bar.

10. **Principles of operation of cam-operated-pump chain oilers** (see Figure 10)

Figure 10: Cam-operated-pump chain oiler



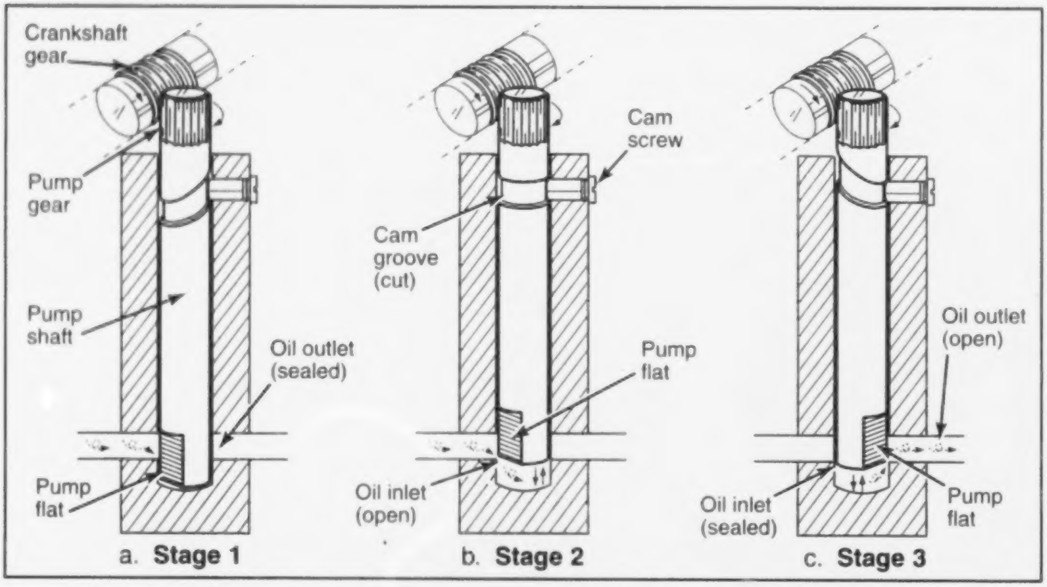
- Oil from the tank accumulates in the pick-up hose and flows into the pump cylinder.
- The operation of the engine rotates a cam so that the eccentric of the cam pushes a plunger.

  Note: The cam is generally located on the crankshaft and may drive the plunger directly or drive a pushrod, which pushes against the plunger. Some oilers are driven by a cam on the gear shaft for gear-driven chains.
- When the pressure of the cam overcomes the resistance of the piston spring, the piston moves in the cylinder, pushing the accumulated oil and drawing in additional oil due to the reduced pressure.
- Oil continues to flow into the cylinder until the piston moves past the inlet port.
- The movement of the piston also pressurizes the oil and forces the check valve (check ball) off its seat.
- Oil moves into the metering chamber and is transferred through the outlet port to the guide bar.

  Note: Some designs include a control screw to regulate the amount of oil going through the outlet port and to the guide bar. By opening the screw, the diameter of the metering-chamber inlet port can be increased to allow a greater flow of oil. Often these designs also provide a means for excess oil to return to the oil tank, as shown in Figure 10 on page 171.
- The continued rotation of the cam moves the eccentric off the plunger so that the piston spring returns the piston and plunger, opening the oil-inlet port and allowing the check valve to close.
- Oil enters the pump cylinder from the tank reservoir.

11. **Principles of operation of gear-driven-pump chain oilers** (see Figure 11)

Figure 11: Gear-driven-pump chain oiler



a. **Stage 1** b. **Stage 2** c. **Stage 3**

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- A gear on the crankshaft drives a gear on the pump shaft as the engine operates.

  Note: The crankshaft gear is often a worm gear (see Figure 11 on page 172).

- A groove in the pump shaft rides on a cam screw, allowing the pump shaft to move up and down as it rotates in the oil chamber.

- A flat on the lower end of the pump shaft allows oil to flow into the chamber at the bottom of the shaft.

  Note: The pump shaft is designed and installed so that the flat faces the inlet port when the pump shaft is at the lowest point of its vertical travel, providing the maximum amount of oil flow (see Figure 11-a on page 172).

- As the shaft continues to rotate, it also moves up in the chamber, causing a pressure reduction in the bottom of the chamber, which draws oil into the chamber.

- After one-quarter turn, the pump shaft reaches its fully up position and the flat faces the side wall of the chamber so that both the inlet port and the outlet port are closed (see Figure 11-b on page 172).

  Note: The cam groove is cut into the shaft in such a way that approximately one-third of the groove is perpendicular to the centerline of the shaft but the other two-thirds form a curve. The perpendicular portion of the groove allows the shaft to make nearly half of its rotation at its highest position, while the curved portion drives the vertical movement of the shaft.

- The continued rotation of the shaft moves the flat to face the outlet port as the shaft begins to move down in the chamber (see Figure 11-c on page 172); simultaneously, the downward motion of the shaft forces the oil through the outlet, from which it is delivered to the guide bar.

12. Types of chain drives and their definitions

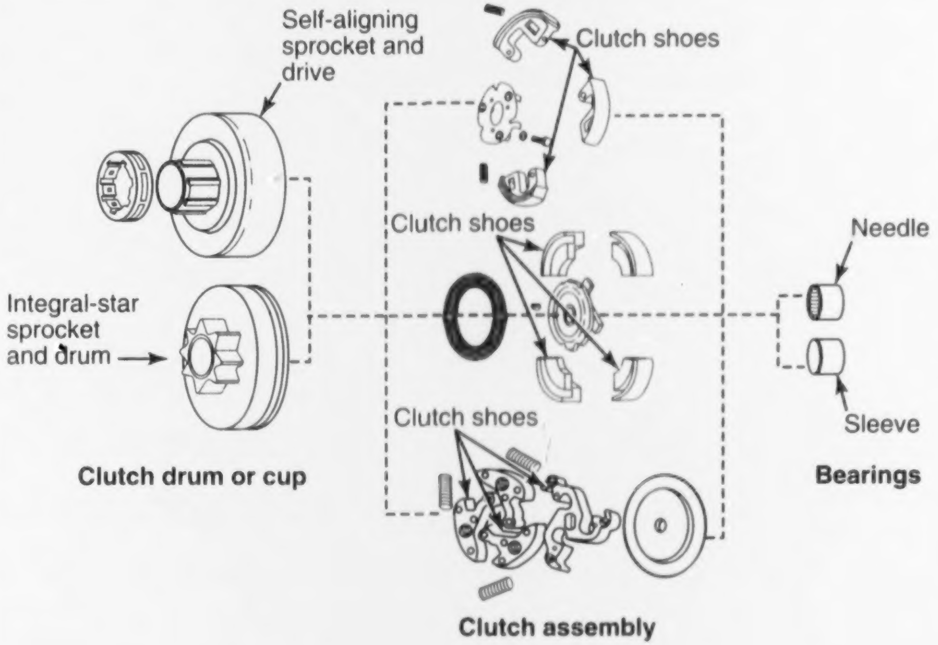
- **Direct** (see Figure 12-a on the next page)—Chain drive using a clutch-and-sprocket assembly (see Objective 13) to transfer power from the crankshaft to the chain

  Note: Direct chain-drive systems are the most common type of chain drive used on chain saws for light-duty applications. The chain rotates at the same speed as the crankshaft because the drive sprocket is simply an extension of the crankshaft once the clutch is engaged.

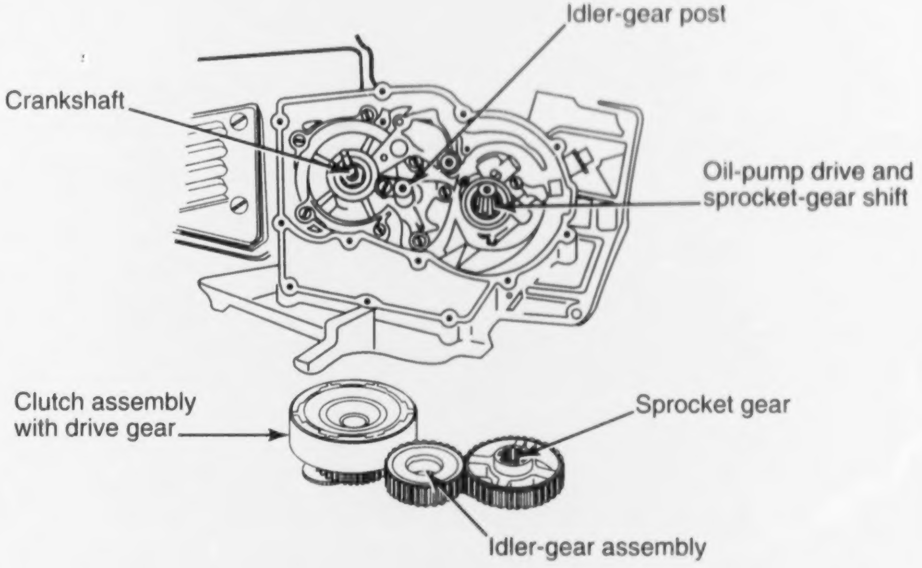
- **Gear reduction** (see Figure 12-b on the next page)—Chain drive using mated gears (see Objective 13) designed to reduce the output speed and increase the torque of the system before it is applied to the work

  Note: Gear-reduction chain drives use a gear train to convert the rotation of the crankshaft to a lower speed at the drive sprocket. As you may recall from your studies of the physics of power product equipment, the energy from such a conversion must remain essentially the same. Thus, if the speed is reduced while the mass remains the same, then the amount of force must increase. Because rotary power is involved, the force is expressed as torque.

Figure 12: Types of chain drives


Self-aligning sprocket and drive
Clutch shoes
Clutch shoes
Needle
Integral-star sprocket and drum
Clutch shoes
Sleeve
Clutch drum or cup
Bearings
Clutch assembly

a. **Direct chain drive**


Idler-gear post
Crankshaft
Oil-pump drive and sprocket-gear shift
Clutch assembly with drive gear
Sprocket gear
Idler-gear assembly

b. **Gear-reduction chain drive**

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13. Types of drive sprockets

Note: There are three basic types of drive sprockets. Each type suffers from wear as it drives the chain around the guide bar, experiences the high speeds and torque of the engine, and absorbs much of the shock of kickback, chains that bind in the cut, improperly adjusted chains, and other problems that increase vibration and resistance. However, the service procedures vary for each. This, coupled with the fact that the sprocket assembly must be properly matched with the chain, makes it critical that the technician understand the design and operation of all three types of drive sprockets.

- **Integral-star sprocket and clutch drum** (see Figure 13-a)

  Note: The integral-star sprocket (star sprocket) is the most commonly used chain-saw drive. This design is used on direct-drive models. Generally, the sprocket is a raised part of the clutch drum, making this design simple and relatively inexpensive. In most cases, service consists of filing down burs that may form or replacing the hub.

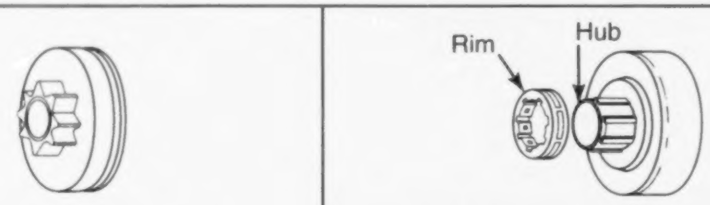
- **Self-aligning sprocket** (see Figure 13-b)

  Note: Self-aligning sprockets, or rim sprockets, are also used on direct-drive systems but are less common and a bit more complex than integral-star sprockets. A self-aligning sprocket consists of two parts: the hub and the rim (see Figure 13-b). The hub is attached to the clutch drum, either as an integral part or as an attachment to the drum. The hub has splines over which the rim fits. The rim is somewhat free to float—it can move in and out along the splines of the hub. This permits the self-alignment feature as the rim automatically aligns with the groove in the guide bar when the chain is installed. Service includes deburring the hub, lubricating the rim, and replacing either or both parts.

- **Gear-drive sprocket** (see Figure 13-c)

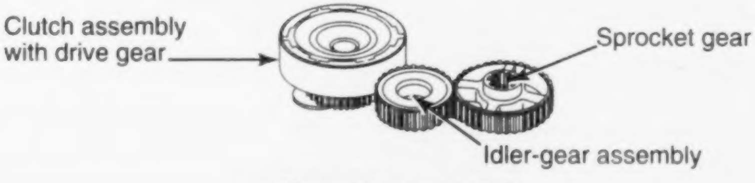
  Note: As indicated by the name, gear-drive sprockets are used with gear-drive systems. Typically, a centrifugal clutch is mounted to the crankshaft with a drive gear integrated into the clutch drum or mounted to it. Once the clutch is engaged, the drive gear transfers force to one or more idler gears that provide the desired gear reduction. The idler gear turns a driven gear that includes an integrated sprocket or is connected to the sprocket by a shaft or fasteners. In addition to lubricating the gear train, service includes replacing worn gears, shafts, bearings, and other parts.

Figure 13: Types of drive sprockets



a. **Integral-star sprocket**

b. **Self-aligning sprocket**



c. **Gear-drive sprocket**

Information Sheet

14. Types of hazards associated with chain-saw operation and their definitions

Note: In order to troubleshoot chain saws and to test those that have been serviced, the technician must be able to operate a chain saw, which includes cutting wood. While there are many dangers associated with operating a chain saw (see Objectives 15 and 16), there are three characteristic behaviors that occur when a moving chain encounters more resistance than the force of the engine can overcome. As described in this objective, these hazards can jerk the saw from the operator's hands or throw the operator off balance, either of which can cause personal injury or equipment damage.

- **Kickback**—Upward motion of the guide bar that occurs when the chain at the nose of the guide bar is suddenly stopped or pinched or contacts a solid object in the wood (see Figure 14-a)

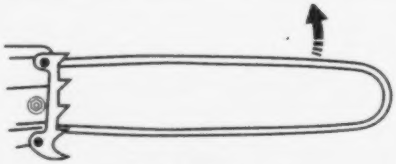
  Note: Kickback is essentially the saw bouncing back from a resistance at the nose tip. Violent kickback can actually send the guide bar back into the face of the operator. For this reason, many saws include features to reduce kickback, such as antikickback chains, or to protect the operator when kickback occurs, such as kickback guards and chain brakes. Note also that although this behavior is described as an upward motion, people operate chain saws in virtually any position so that kickback may drive the saw down or to the side or in any direction away from the point of contact.

- **Pushback**—Backward motion of the saw—toward the operator—that occurs when the chain on top of the guide bar is suddenly stopped or pinched or contacts a solid object in the wood (see Figure 14-b)

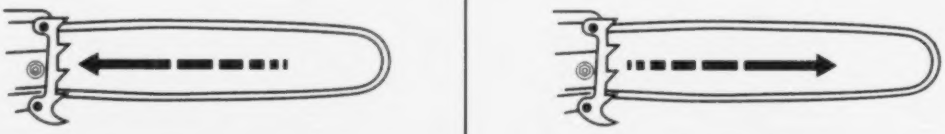
  Note: A common practice among chain-saw operators is to use the chain on top of the guide bar to undercut small branches and limbs on standing trees or those being cut for firewood. A problem that may develop from this practice is that gravity pulls the limb down, closing the cut and applying pressure to the chain, which can cause the chain to bind and stop.

- **Pull-in**—Forward motion of the saw—away from the operator—that occurs when the chain at the nose of the guide bar is suddenly stopped or pinched or contacts a solid object in the wood (see Figure 14-c)

Figure 14: Chain-saw operational hazards



a. **Kickback**



b. **Pushback**

c. **Pull-in**

Information Sheet

15. Safety rules for servicing chain saws

- **Read the service or owner's manual and follow the safety guidelines included in the publication.**

- **Wear proper safety equipment.**

  Note: The owner's manual will spell out the safety equipment that should be worn. In actual field use, such gear may include a hard hat and steel-toed shoes and leg guards or chaps. For the service technician in the shop, those items are probably not required; however, long, but not loose sleeves, leather gloves, and goggles or safety glasses with side shields should be worn.

- **Place the chain saw on a solid surface to start it.**

  Note: Starting a chain saw requires that the saw be held away from the operator while the rope is pulled toward the operator. This is not an easy maneuver to complete unless the operator is able to brace the saw against a solid surface, especially if the engine is not correctly tuned so that it is difficult to start or starts at a high speed. If the saw is not stable as it is being started, there is a danger that the operator will slip and be injured by the chain cutters even if the saw does not start.

- **Never operate a chain saw with a loose chain.**

  Note: A loose chain can come off the guide bar and cause injury and is more likely to bunch up, causing kickback, pushback, or pull-in.

- **Never carry a chain saw from place to place while the saw is running.**

  Note: If a chain saw is running, the chain may catch the operator's clothing or, if the operator falls, may injure the operator in the fall.

- **Always carry a chain saw with the guide bar pointing toward the rear.**

  Note: If the chain saw is dropped or if the operator stumbles, the likelihood of injury is less if the guide bar is behind the operator.

- **Always keep both hands on the chain-saw grips while the saw is running.**

  Note: It is much easier to control a chain saw using two hands rather than one. Using two hands may keep the saw from accidentally contacting an object or part of the operator's body. Also, if both hands are on the chain-saw grips, the operator is less likely to place a hand on the moving chain.

- **Follow the manufacturer's directions for using the specialty tools required for chain-saw service.**

16. Protective equipment to be worn during chain-saw service

Note: While servicing chain saws, technicians are often required to operate the equipment to diagnose problems, to make adjustments, or to check post-service operation. Post-service tests often require the technician to cut wood. Whenever the chain saw is operating, all of the equipment listed should be used. At other times during the service procedures, some of the equipment mentioned would be impractical, such as wearing heavy-duty gloves while adjusting the needle valves of a carburetor. However, in a shop environment, some protective equipment may be required whenever chain-saw service is being performed, even if some technicians are not working on chain saws. For example, eye and ear protection are recommended any time a chain saw is being operated in a shop. Naturally, service personnel must follow the protective-equipment requirements of their facility.

- **Protective clothing**

  Note: While no special clothing is necessary, the clothing a technician wears when performing chain-saw service should include protection for the legs and arms, such as pants and long-sleeve shirts. The clothing should be loose enough to allow freedom of movement but snug enough to avoid presenting a hazard of getting caught in a moving chain. Technicians should also avoid loose jewelry, long unpinned hair, and other personal apparel that may become entangled with the chain.

- **Heavy-duty, non-slip-design gloves**

- **Heavy-duty, steel-toed safety boots with non-skid soles**

- **Eye protection**

  Note: The best protection is provided by a face shield, which should be worn whenever the technician cuts wood with a chain saw. During other service procedures, adequate protection is provided by vented goggles or safety glasses.

- **Head gear**

  Note: Your head should be protected whenever you are operating a chain saw due to the danger of flying debris and kickback. A hard hat is recommended if the technician is cutting timber; a hat or cap is adequate if the technician is simply running the chain saw.

- **Industrial-quality ear muffs or shooter's ear plugs**

  Note: The noise from a single chain saw can be loud enough to cause hearing loss with prolonged exposure. Obviously, the technician operating a chain saw should wear ear protection. However, in an enclosed shop environment where several chain saws and possibly other equipment may be operating simultaneously, you should routinely wear ear protection.

17. Specialty tools used in chain-saw service and their functions

Note: Many of the hand and power tools used to service other types of power product equipment are used to service the engine, fuel system, starting system, ignition system, and other components of chain saws. However, the chain and guide-bar service constitute a large percentage of the work performed on chain saws, and a number of the tools used in that service are unique to chain-saw work.

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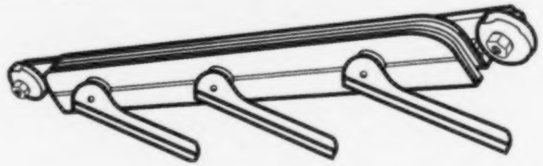
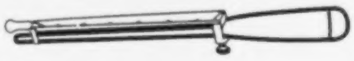
- **Chain-filing vise** (see Figure 15-a)—Used to hold the chain so that it can be filed and to help achieve a good angle for filing
- **Full-round file** (see Figure 15-b)—Used to maintain a proper profile on the drive links and cutters and to create a good cutting edge or shaped face, such as the curve of a drive-link hook
- **File guide** (see Figure 15-c)—Used to help the technician maintain a correct angle when sharpening the cutters so that each plate is filed in the same way

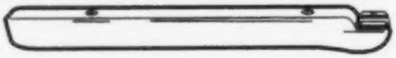
Figure 15: Specialty tools



a. **Chain-filing vise**



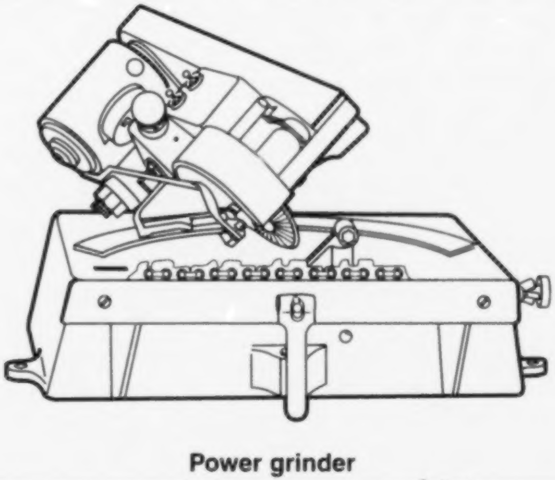
b. **Full-round file and holder**



c. **File guide**

- **Power grinder** (see Figure 16)—Used to shape and sharpen cutters and to shape drive links and other chain parts

Figure 16: Specialty tools (cont.)



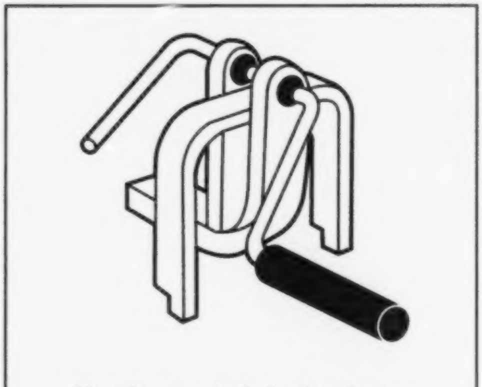
Power grinder

Information Sheet

- **Hand-operated rivet spinner** (see Figure 17)—Used to install rivets when assembling chains

  Note: While chains are available in specific lengths and gauges for particular models of chain saws, many facilities assemble chains. The chain may be fabricated using assembled chain sections that are simply riveted together to create chains of the correct length, or they may be fabricated from loose components such as cutters, tie straps, drive links, and rivets.

  Figure 17: Specialty tools (cont.)

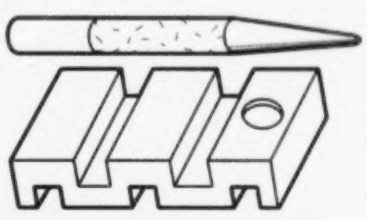


Hand-operated rivet spinner

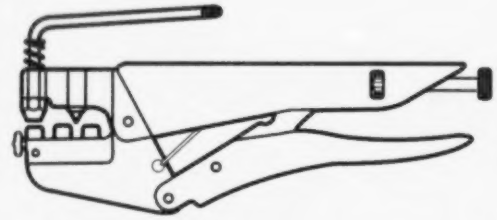
- **Pocket-sized chain breaker** (see Figure 18-a)—Used to remove rivets from assembled chains
- **Multi-purpose tool** (see Figure 18-b)—Used to remove rivets and to install rivets by hand operation
- **Bench chain breaker and spinner** (see Figure 19 on the next page)—Used to remove rivets and to install rivets as a fixed shop tool

  Note: A bench chain breaker and spinner may be purely mechanical or it may use hydraulic fluid to multiply force.

Figure 18: Specialty tools (cont.)



a. **Pocket-sized chain breaker**



b. **Multi-purpose tool**

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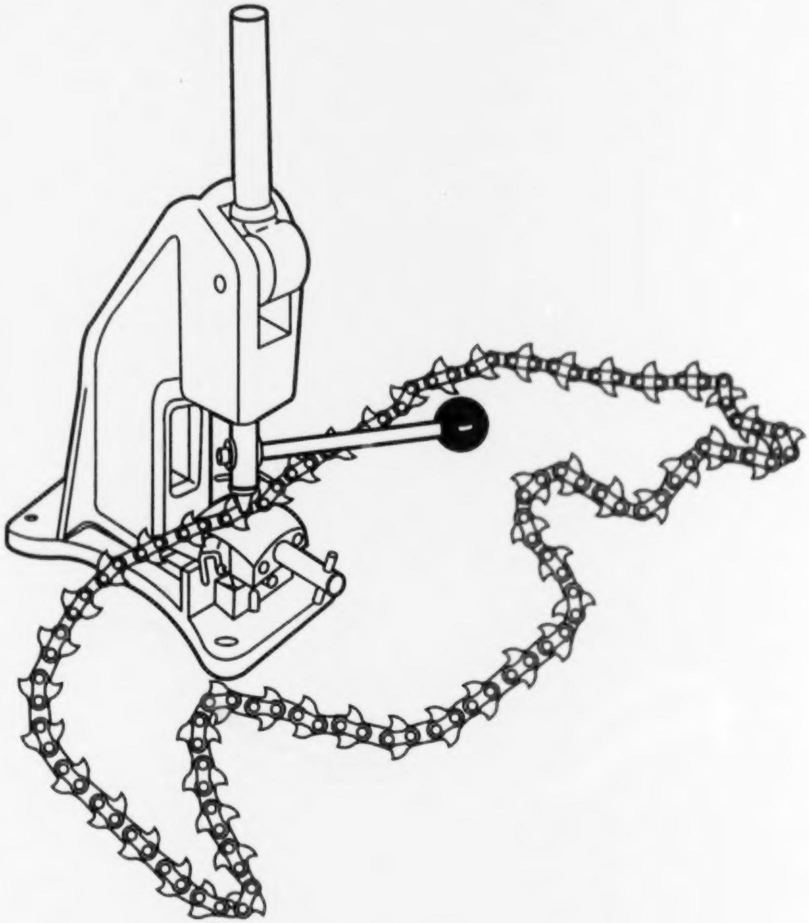
Figure 19: Specialty tools (cont.)



Bench chain breaker and spinner

18. Typical service procedures required for chain saws

- Service engine, including carburetor adjustment and repair
- Replace chain
- Sharpen or reshape chain components
- Shorten chain
- Repair guide bar
- Replace guide bar

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- Replace replaceable components of guide bar
- Lubricate guide-bar rollers
- Debur guide-bar rollers
- Repair clutch and sprocket components
- Replace clutch and sprocket components
- Pack or lubricate clutch bearings
- Repair oiler
- Replace oiler
- Repair rewind starter
- Replace rewind starter
- Service support components

Note: Support-component service for most chain saws will include repair, adjustment, or replacement of throttle switches, stop controls, grips, guide-bar adjusting hardware, mufflers, and other components. Some chain saws feature components not typically found on most models, such as chain brakes and vibration isolators, that may require adjustment or repair.

Chain Saws
Unit 4

Student Supplement 1—Troubleshooting Problems with Chain Saws

Introduction

You have already studied many types of power product equipment and should be able to see many similarities and differences between those types of equipment and chain saws. The service of the engine and its related systems is fairly comparable between chain saws and other types of equipment that use two-stroke-cycle engines. The major area of difference in required service is the maintenance of the chain-saw cutting system, which consists primarily of the chain and guide bar. In fact, the majority of chain-saw service involves these two components and one engine system—the fuel system.

While the fuel system of a chain saw is essentially the same as that of other two-stroke-cycle engines, there are several aspects of chain-saw design and operation that lead to increased incidence of carburetor problems. Typically, a chain saw is taken down from a shelf where it has been sitting for months, often with the fuel/oil mixture left in the tank. It is thrown into the back of a pickup and carried over bumpy roads to a wet or dusty forest, where it is run for several hours in an environment of flying saw dust and wood chips. Then it is thrown back into the pickup, transported back over those bumpy roads, and returned to the shelf with hardly a second thought.

This kind of operational life wrecks havoc on the chain saw in general and the fuel system in particular. Thus, it is not surprising that on one of these trips to the woods, the chain saw does not start and the owner brings it to your shop wondering why.

In short, much of the maintenance that you will perform on chain saws as a service technician will involve the chain, the guide bar, or the carburetor. This supplement provides you with information that will be helpful in troubleshooting problems with these systems and in providing the required service.

Chain failure

Ordinarily, a chain-saw chain should be expected to provide long, trouble-free service. Periodic sharpening will be required, and occasionally, the technician will be required to file drive links or other parts of the cutters to restore them to their original configuration. The chain will lengthen during use but is still usable by the removal of one or more links. Thus, if chain failure is common for a chain-saw owner, the service technician should help the customer determine the source of the shortened operational life of the chain. The following is a list of common reasons for chain failure.

- **Chain improperly adjusted**

  A chain that is too tight is under stress, while one that is too loose will slap the sprocket, guide bar, and other parts, causing excessive wear. Manufacturers include recommendations for the amount of slack that should be in the chain. For example, the recommended slack may be ¼ inch when medium pressure is applied to lift the chain at the midpoint of the top of the guide bar.

- **Worn or damaged bar groove**

- **Lack of lubrication**

  Poor lubrication may result from a faulty oil-delivery system, running the oil tank out of oil, a clogged oil-tank port, poor-quality oil, and similar factors.

- **Improper filing or sharpening**

  If the alignment of the chain is changed through improper service, it can cause the center links to be loose or drive the chain at a bad angle. If the cutters are not properly sharpened, they may dig into the wood too deeply adding strain on the chain or they may not cut enough, causing the chain to have to operate excessively to make the same depth of cut.

- **Abrasion**

  Abrasion generally results from using dirty lubricating oil, not keeping the chain or guide bar clean, working in dirty conditions, cutting overly hard or contaminated materials, etc. While chain saws are usually used to cut timber, fire departments, rescue squads, demolition crews, and other workers often use them to cut through wood and nonwood materials, including roofing materials, lumber with nails and other fasteners, siding, doors, cabinets, furniture, and other items.

- **Worn out roller nose**

- **Improper use**

- **Damaged sprocket teeth**

  Damaged sprocket teeth add vibration to the chain travel or cause it to have periods of slack that are suddenly taken up as the sprocket continues to operate.

If a customer complains of early chain failure or if you notice that you are replacing the chain for a customer more often than should be expected, try to determine the reason for failure (which is a good practice whenever you deal with material failure). As you may recall, two of the major sources of information in performing failure analysis are the customer and an inspection of the equipment.

A review of the list of probable causes of chain failure will reveal that some of the information can be obtained by inspecting the chain saw. For example, if the drive sprocket is severely worn, that condition could contribute to the chain failures.

Other probable causes may be evident from information provided by the customer. For example, if you ask what the customer has been doing with the chain saw and the answer is "cutting sheet metal," you may have discovered the cause.

Remember, too, chain failure may be the result of combinations of conditions such as those listed previously. Just because a probable cause has been identified, good failure analysis requires that other possible contributors be explored.

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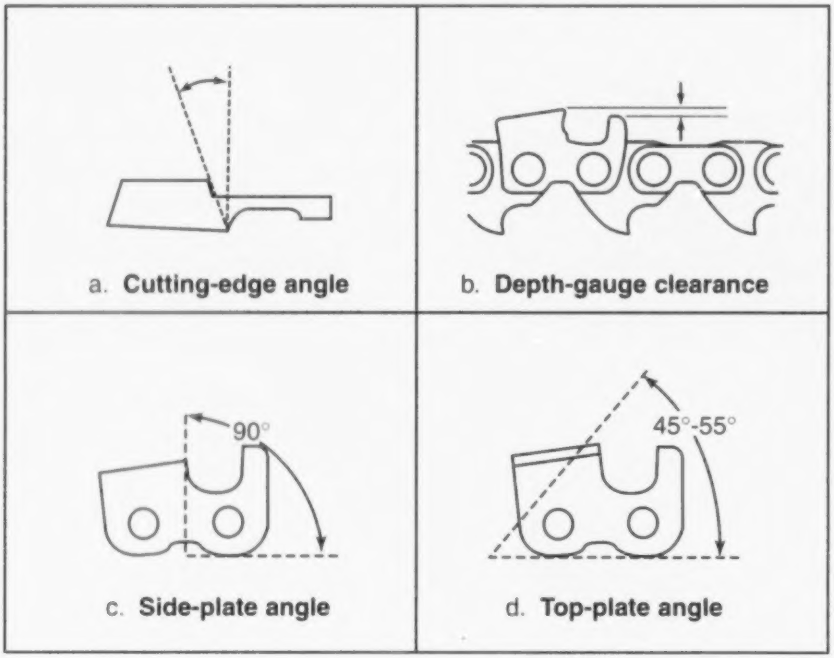
Chain sharpening

As noted in the previous section, improper filing or sharpening of the chain may lead to its early failure. Additionally, dull or improperly filed cutters can lead to numerous other problems that affect the performance of the chain saw and make the work more tiring for the operator. Some of these include:

- Poor, inefficient cutting
- Excessive fuel consumption
- Excessive load on the engine
- Increased wear on bar, sprocket, and engine
- Increased probability of kickback

Many chain saws come with files and file guides. Even though the tools are provided, most chain-saw owners lack the skills and experience to do a proper job of sharpening a chain. Proper maintenance of a chain begins with an understanding of the geometry of the cutters. Such geometry includes the cutting-edge angle, depth-gauge clearance, side-plate angle, and top-plate angle, as shown in Figure 1.

Figure 1: Chain-saw cutter geometry



a. **Cutting-edge angle**

b. **Depth-gauge clearance**

c. **Side-plate angle**

d. **Top-plate angle**

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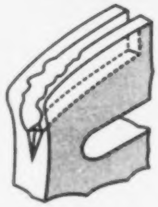
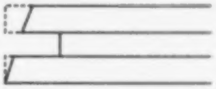
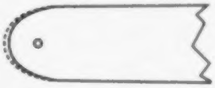
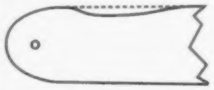
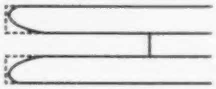
The dimensions of the required angles will vary depending on the type of cutter used, such as a chipper or chisel. For example, a typical chipper uses a cutting-edge angle of approximately 35 degrees, while a chisel cutter might use a 20-degree cutting-edge angle. You should refer to the service manual for exact guidelines for cutter geometry and sharpening procedures.

Guide-bar damage

Naturally, guide bars are subject to wear as the chain runs along its edge; however, the technician should be alert to excessive or abnormal wear. Excessive wear means that the groove becomes deeper or that the rails become worn sooner than should be expected. Abnormal wear consists of various types of wear that generally indicate that the chain is not moving smoothly or properly around the guide bar. Figure 2 shows some common examples of types of abnormal guide-bar wear and lists their probable causes

Figure 2: Guide-bar damage/causes

Type of damage	Probable cause
Rail damage of chain entry 	• Crowding at entry when chain is loose
Excessive wear on one rail 	• Inconsistent face angles • Unequal joint setting
Nose tip worn 	• Excessive chain tension • Insufficient lubrication • Cutting with dull or damaged cutters
Rail tops worn 	• Chain slap from loose chain • Undercutting with dull or damaged chain • Cutting with insufficient joint
Inside of rails worn 	• Inconsistent face angles • Excessive face angles • Excessive joint

Student Supplement 1

Repair of some guide-bar problems is possible, though in many instances the guide bar will need to be replaced. Typically, manufacturers will allow the straightening of short portions of the rail by inserting a shim into the groove and hammering the rail back into place. Replaceable inserts, such as solid noses and roller noses, can be replaced. Follow the manufacturer's recommended service procedures or replace the bar guide.

Remember, too, a worn guide bar can indicate other problems that need to be addressed. For example, if a worn nose tip is the result of a clogged oiler line, the oiler should be repaired when the guide bar is replaced.

Carburetor problems

As noted in the introduction to this supplement, the way that chain saws are handled and used frequently leads to fuel-system-related problems. Often these problems stem from improper adjustment of the carburetor, incorrect fuel mixtures, contaminated fuel or the buildup of varnish in the carburetor, and similar problems.

A particular concern with chain saws is the ratio of the fuel/air mixture. Recall that a mixture that has too little fuel compared to the amount of air is referred to as *lean* while a mixture with too much fuel in comparison to the amount of air is referred to as *rich* and leads to a flooded engine. These mixtures affect the operation of the engine but also raise issues about equipment damage and personal safety. One reason for this is that chain saws generally use a two-stroke-cycle engine, which because of the use of oil in the fuel for lubrication, depends on having a proper fuel mixture for good lubrication. Second, engine speed is so important to the operation of the chain saw and clutch engagement that any misadjustment of the carburetor may mean that the chain runs when it should not or does not rotate when it should. Finally, if a chain saw is difficult to start, there is an increased danger of injury to the operator due to pulling harder and the operator's becoming frustrated. For these reasons, a technician should become specifically familiar with the causes of lean and rich carburetor conditions.

The causes of lean and rich carburetor conditions are listed in Figure 3. Note that all of the causes listed deal with parts that need to be cleaned, adjusted, or replaced. Figure 4 correlates each of the probable causes of lean/rich conditions with remedies for each condition.

Figure 3: Causes of lean/rich carburetor conditions

Cause of lean condition	Cause of rich condition
• Metering lever set too low • Dirt under needle valve • Welch plugs leaking • Metering-lever spring not seated properly • Fuel-pump diaphragm leaking	• Dirt in idle main channels • Metering lever set too high • Hole in metering diaphragm • Pulse line from crankcase to carburetor plugged • Leaky manifold gasket • Leaky nozzle check valve • Fuel-pump check valves worn • Dirty fuel-inlet screen • Faulty fuel-delivery system to the carburetor • Leaky accelerator diaphragm

Figure 4: Causes/remedies of lean/rich carburetor conditions

Cause	Remedy
• Dirt under needle valve • Dirt in idle main channels • Pulse line from crankcase to carburetor plugged • Dirty fuel-inlet screen	Clean
• Metering lever set too low • Metering-lever spring not seated properly • Metering lever set too high	Adjust
• Welch plugs leaking • Fuel-pump diaphragm leaking • Hole in metering diaphragm • Leaky manifold gasket • Leaky nozzle check valve • Fuel-pump check valves worn • Faulty fuel-delivery system to the carburetor • Leaky accelerator diaphragm	Replace

Conclusion

By becoming familiar with the conditions and causes described in this supplement and the applicable service procedures in the manufacturer's service manuals, you should be able to correct many of the most common problems exhibited by chain saws. Additionally, this information will be valuable when troubleshooting other problems and during the failure-analysis process.

Chain Saws
Unit 4

Assignment Sheet 1—Calculate Fuel-Mix Ratios

Name ______________________________ Date ______________

Evaluation criteria **Rating**

Directions have been followed. ______

Minimum of 80 percent of answers are correct. ______

Overall rating ______

Evaluator's comments ______________________________

____

____

Introduction

Many chain saws use two-stroke-cycle engines. Often these engines operate on fuel that is a mixture of gasoline and oil. To operate properly, the ratio of gasoline to oil must be that specified by the manufacturer. Often manufacturers provide charts that show the number of pints or ounces of oil to be added to a specific amount of gasoline as shown in Figure 1 on the next page.

Technicians must operate chain saws as part of their troubleshooting and maintenance procedures. They must also be able to assist customers in determining correct fuel-mixture ratios. For that reason, a service technician must be able to calculate proper fuel-mixture ratios. This assignment sheet will provide you with practice in calculating those ratios.

Exercise

Directions

Using the chart in Figure 1 on the next page, calculate the fuel ratios for the following situations. Write your answers on the blank line provided under each question. Show your calculations in the space provided under each question.

Assignment Sheet 1

Figure 1: Fuel-mixture chart

	Mixture ratio	Gallons of gasoline	to	Pints of oil	or	Ounces of oil
	16:1	2	:	1		16
Most-common ratios	**20:1**	**2 ½**	**:**	**1**		16
	24:1	**3**	**:**	**1**		16
	40:1	5	:	1		16
	50:1	6 ¼	:	1		16

1. If an engine calls for a 40:1 mixture, how much oil should be added to 5 gallons of gasoline?

   Pints — ________________ Ounces — ________________

2. The manufacturer recommends a fuel-mixture ratio of 16:1. How much oil is required for 2 gallons of gasoline?

   Pints — ________________ Ounces — ________________

3. A technician has 1 pint of oil and is mixing fuel for an engine that specifies a ratio of 20:1. How much gasoline is required for a correct mixture?

   Gallons — ________________________________

4. If the specified mixture ratio is 24:1, how much oil is required for 3 gallons of gasoline?

   Pints — ________________ Ounces — ________________

5. A 15-gallon gasoline can has 12.5 gallons of gasoline. How much oil should be added to make a fuel-mixture ratio of 50:1?

   Pints — ________________ Ounces — ________________

Chain Saws
Unit 4

Assignment Sheet 2—Calculate Chain Pitch

Name ______________________________ Date ______________

Evaluation criteria **Rating**

Directions have been followed. ________

Minimum of 80 percent of answers are correct. ________

Overall rating ________

Evaluator's comments ______________________________

____

____

Introduction

For a chain saw to operate properly, the chain must be the proper dimensions. The two major dimensions are the overall length of the chain and the spacing between chain links, which is referred to as *pitch*. The actual measurement is based on the distance between two rivets, such as the cutter toe-end rivet (A) and the next tie-strap toe-end rivet hole (B) as shown in Figure 1 on the next page.

The distance shown as C in Figure 1 can be measured, but it does not represent pitch because two links are involved. Pitch is half this distance, and is calculated by dividing the measured distance by 2.

By calculating pitch, a technician can tell if a chain and sprocket are properly matched, whether the chain has stretched too much or if the sprocket is too worn. In this assignment sheet, you will practice calculating pitch.

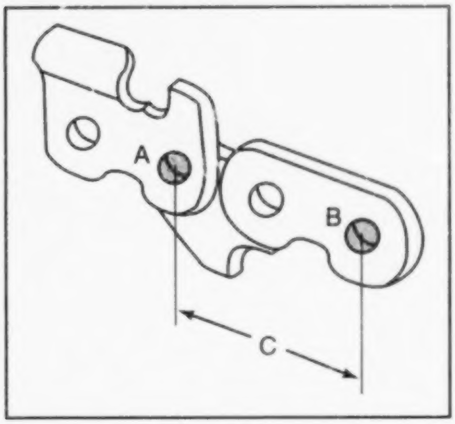
Exercise

Directions

Each problem on the next page provides the measured distance for the dimension labeled as C in Figure 1 on the next page. Calculate the pitch for each measured distance given. Write your answers on the blank line provided under each question. Show your calculations in the space provided under each question.

Assignment Sheet 2

Figure 1: Measured rivet distance



1. Dimension C is ⅞ inch. What is the pitch?

   Pitch — ______________________________

2. Dimension C is 1½ inches. What is the pitch?

   Pitch — ______________________________

3. Dimension C is 1 inch. What is the pitch?

   Pitch — ______________________________

4. Dimension C is 1⅛ inches. What is the pitch?

   Pitch — ______________________________

5. Dimension C is ¾ inch. What is the pitch?

   Pitch — ______________________________

Chain Saws
Unit 4

Assignment Sheet 3—Determine Chain-Saw Service Specifications and Parts Requirements

Name ______________________________ Date ______________

Evaluation criteria **Rating**

Directions have been followed. ______

Minimum of 80 percent of answers are correct. ______

Overall rating ______

Evaluator's comments ______________________________

____

____

Introduction While the use of correct parts and specifications is important for all power product equipment, chain saws present many special problems with regard to parts and specifications. For one thing, it is often difficult to identify the exact model of chain saw being serviced. Even if the model is correctly identified, configurations can vary greatly over time so that a saw manufactured in 1995 may have a different oiler than one manufactured in 1998 or after a given serial number. Additionally, some specifications may vary for different lengths of guide bars or types of chains. For these reasons, the technician may be required to do further research to determine correct part numbers and specifications. This assignment sheet will provide you with practice in determining chain-saw specifications and part numbers.

Exercise

Directions Your instructor will assign chain-saw makes and models for each problem on the following pages. Using the resources available in your facility, determine the part numbers and specifications requested. Write your answers on the blank lines provided with each problem.

Assignment Sheet 3

1. Your instructor will list five chain saws on the blanks under the "Chain-saw make/model" column in the table below. Determine the carburetor make and model used on each of these chain saws.

	Chain-saw make/model	Carburetor make/model
a.		
b.		
c.		
d.		
e.		

2. Your instructor will list five chain saws on the blanks under the "Chain-saw make/model" column in the table below. Determine the make and model of spark plug and the spark-plug-gap setting used on each of these chain saws.

	Chain-saw make/model	Spark-plug make/model	Gap setting
a.			
b.			
c.			
d.			
e.			

3. Your instructor will list five chain saws on the blanks under the "Chain-saw make/model" column in the table below. Determine the recommended fuel-mix ratio for each of these chain saws.

	Chain-saw make/model	Fuel-mix ratio
a.		
b.		
c.		
d.		
e.		

Assignment Sheet 3

4. Your instructor will list five chain saws on the blanks under the "Chain-saw make/model" column in the table below. Determine the type of drive (direct or gear reduction) used on each of these chain saws? If the equipment uses a direct drive, give the torque value for the sprocket fastener; if the equipment uses a gear-reduction drive, give the torque value for the idler-gear fastener.

	Chain-saw make/model	Drive type	Torque
a.			
b.			
c.			
d.			
e.			

5. Your instructor will list five chain saws on the blanks under the "Chain-saw make/model" column in the table below. Determine how the automatic oiler is driven (pulsation, cam, or gear) in each of these chain saws and note whether or not the chain saw includes a manual oiler by writing a "yes" or a "no" in the last column in the table.

	Chain-saw make/model	Automatic-oiler drive method	Manual oiler (yes or no)
a.			
b.			
c.			
d.			
e			

Chain Saws
Unit 4

Assignment Sheet 4—Troubleshoot Poor Performance in Chain Saws

Name ______________________________ Date ______________

Evaluation criteria	**Rating**
Directions have been followed.	_______
Minimum of 80 percent of answers are correct.	_______
Overall rating	_______

Evaluator's comments ______________________________

____

____

Introduction You are familiar with troubleshooting procedures and have applied them to numerous types of equipment in past lessons. However, you have done little troubleshooting of chain-saw performance. As noted in Student Supplement 1, there are certain types of problems that account for the majority of chain-saw maintenance. While some of these are routine service procedures, the technician should always use these opportunities to evaluate the condition of the chain saw. For example, if a customer has requested that a chain be sharpened and a technician notices an abnormal wear pattern on the chain while sharpening it, other problems may exist. This assignment sheet provides you with exercises that require you to make troubleshooting decisions involving chain saws.

Exercise

Directions Each problem below describes a chain-saw condition or operation. Read each problem and, using the information in Student Supplement 1, answer the questions that accompany each problem. Write your answers on the blank lines provided under each question.

1. A chain saw is running too lean. An inspection of the carburetor reveals dirt under the needle valve. What is the recommended remedy for this condition?

   Recommended remedy ______________________________

   ____

2. A customer complains that his chain saw is going through chains too quickly and that the chain saw vibrates a lot when he uses it. The chain is equipped with chipper cutters. You find that the cutting-edge angle is approximately 20 degrees. Is this the correct cutting-edge angle and is it possible that this condition may be causing the problem?

   ____

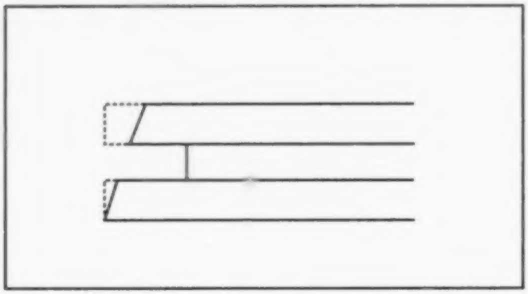
   ____

Assignment Sheet 4

3. A chain-saw guide bar exhibits uneven wear of the rails at the nose tip as shown in Figure 1. Which of the following is the probable cause? (Circle the correct answer.)

   - Loose chain
   - Inconsistent face angles
   - Insufficient lubrication

Figure 1



4. A chain-saw engine is running too rich. Is it more likely that the metering lever is set too high or too low, and what should be done to remedy the condition?

5. When examining a chain saw that has experienced chain failure, you determine that the metering valve in the automatic oiler is fully tightened so that the inlet port is closed. How could this have contributed to the chain failure?

Chain Saws
Unit 4

Job Sheet 1—Perform Routine Maintenance on Chain Saws

Introduction

This job sheet covers the routine maintenance associated with chain saws. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Service engine
- Lubricate gears, chains, and sprockets
- Adjust chain tension
- Service oiler
- Sharpen or replace chain

Procedure

1. Study all of the objectives in the information sheet and complete Assignment Sheets 1 through 4.

2. Watch your instructor's demonstration of routine service of a chain saw and any supporting media provided by your instructor.

3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one chain saw. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.

4. Ask your instructor to provide you with a chain saw that requires routine maintenance.

5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.

6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.

7. Using the instructor-approved service information and equipment/materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 1

Worksheet—Perform Routine Maintenance on Chain Saws

Name ______________________ Attempt number __________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 1

Worksheet—Perform Routine Maintenance on Chain Saws

Part B: **Performance evaluation**

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

____

____

Chain Saws
Unit 4

Job Sheet 2—Repair Chain Saws

Introduction

This job sheet covers the repair procedures associated with chain saws. You will accomplish these tasks by following the appropriate procedures in the manufacturer's service manual. While the specific procedures will depend on the equipment design and manufacturer's processes, the general tasks that may be performed under this procedure include

- Replace drive components, including gears, sprockets, etc.
- Overhaul major subsystems, including bars, oilers, starter, etc.
- Change bar type and size
- Perform adjustments to return equipment to original specifications

Procedure

1. Study all of the objectives in the information sheet and complete Assignment Sheets 1 through 4.

2. Watch your instructor's demonstration of repairing a chain saw and any supporting media provided by your instructor.

3. Review the following worksheet associated with this job sheet. You may be required to accomplish this job sheet for more than one chain saw. Check with your instructor, and obtain a copy of the worksheet for each attempt that will be required.

4. Ask your instructor to provide you with a chain saw that requires repair.

5. Complete the pre-performance check (Part A) on the worksheet and receive your instructor's signed approval for the service information you have located and the equipment/materials you have listed for performing the procedure on the equipment assigned.

6. Review the evaluation criteria listed in the performance evaluation (Part B) on the worksheet.

7. Using the instructor-approved service information and equipment/materials list, perform the appropriate procedure. Your instructor will rate your performance using the evaluation criteria listed in the performance evaluation on the worksheet.

Job Sheet 2

Worksheet—Repair Chain Saws

Name ______________________ Attempt number ________

Date ______________________

Part A: Pre-performance check

Job ______________________

- Complete the following information concerning the assigned equipment.

  Equipment brand ______________________

  Equipment model/type and code ______________________

  ____

- Complete the following service-manual information.

  Service-manual title ______________________

  Section/page number of procedure ______________________

- List type and number of replacement parts.

- List special equipment/materials required for procedure.

Instructor's signature ______________________

Job Sheet 2

Worksheet—Repair Chain Saws

Part B: Performance evaluation

Evaluation criteria	**Rating**
Correct procedures identified for assigned equipment.	______
Procedures completed correctly.	______
Proper tools used correctly.	______
Safety precautions observed.	______
Service meets specifications.	______
Clean-up and follow-up actions adequate.	______
Overall rating	______

Evaluator's comments ____

____

____

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